ECS Evaluation Packages Strategic Plan EP7 Update

DRAFT White Paper

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Abstract

Evaluation Packages are an early delivery mechanism that allow portions of ECS functionality to be placed into the hands of selected users for evaluation and design iteration in advance of formal system releases. As such, they help avoid late discovery that what has been produced is not that which is desired.

This white paper describes the plan and process for the delivery and evaluation of the ECS Evaluation Packages (EP). The objectives of this document are to 1) provide an overview of the EP process to set the context for planning, 2) define a projected plan for the content of each evaluation package delivery, and then 3) define the detailed process structure for development, test, installation, evaluation, and maintenance of those deliveries. This document is intended to evolve, reflecting the continuously improving EP process, based on lessons learned during the incremental development, prototyping, studies and evaluation process.

This version of the white paper was prepared at the beginning of development for EP7. It will serve as the strategic plan for EPs until updated at the beginning of development for EP8 (Release C).

For a rapid overview of the EP plan see the following items :

- EP Schedule (Figure 2-2)
- EP Lifecycle (Figure 2-7)
- Development Methodology by Subsytem (Table 3-2)
- Summary of Content by EP (Table 3-3)
- SDPS Content (Figure 4-1)
- CSMS Content (Figure 5-3)
- EP Evaluations: Methods and User Groups (Table 10-1)

Keywords: Evaluation Package, Incremental Track, SDPS, CSMS, Client Subsystem, Data Management Subsystem, ESST, Java, Web, LIM, Data Dictionary, V0 Gateway, Prototype

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1. Introduction

1.1   Purpose

This white paper describes the plan and process for the delivery and evaluation of the ECS Evaluation Packages (EP). This is an update to the original document, MA9402V1 and its subsequent version, 222-WP-003-001 (EP6 timeframe). The objectives of this document are to 1) provide an overview of the EP process to set the context of planning, 2) define a projected plan for the content of each evaluation package delivery, and then 3) define the detailed process structure for development, test, installation, evaluation, and maintenance of those deliveries.

1.2   Related Documents

This document was developed using the concepts and processes described in several ECS White Papers, ECS CDRLs and EOSDIS Planning Documents. The documents that are related to this EP Strategic Plan are:

107/MG1   Level 1 Master Schedule, Current Issue

108/MG2   Intermediate Logic Network Diagrams, Current Issue

201/SE1   ECS System Engineering Plan, Current Issue

FB9403V3   ECS Release Plan Content Description, June 1994

Note: The above list represents only the most applicable subset of a number of related documents.

1.3   Organization

Summary descriptions for each section of this white paper are provided in Table 1-1.

1.4   Review and Approval

This White Paper is an informal document approved at the joint ECS Office Manager level. It does not require formal Government review or approval; however, it is submitted with the intent that review and comments will be forthcoming. It is expected that the ETMs for each ECS segment will be interested in reviewing this paper and in providing feedback to the authors to assist in guiding the EP process.

The draft version of this white paper is being circulated as part of the objectives planning and validation for EP7. This white paper seeks to illustrate the strategic aspect of implementing an EP as part of the incremental track. This paper is being distributed early in the EP7 process to provide reviewers with a strategic perspective. Comments on this paper should be directed to Keith Bryant via the contacts listed below.

The plans and objectives expressed in this White Paper remain valid until superseded by the next release. The concepts presented here are expected to be consistent with the ECS System Engineering Plan, CDRL 201.

Table 1-1. Section Descriptions

	Section	Description
1.	Introduction	Purpose and Organization of this White Paper, Related Documents, and Contacts for further information
2.	EP Process	Description of EP Process including EP Master Schedule, relationship with incremental development and prototypes, detailed description of an EP Life Cycle, and EP evaluators.
3.	EP Strategy Development	Development of EP strategy based upon capabilities required for Release B of ECS. Guidelines for determining content for incremental development are provided.
4.	SDPS Deliveries by EP	An overview of the SDPS development is followed by the SDPS EP strategy and summary descriptions of the content of each EP and Prototype Workshop.
5.	CSMS Deliveries by EP	An overview of the CSMS development is followed by the CSMS EP strategy and summary descriptions of the content of each EP.
6.	Science Datasets and Science Support Scenarios	Description science scenarios to be used for the EP evaluations along with the datasets to be used
7.	Segment EP Interfaces	Timeline for the development of segment-to-segment interfaces required for EPs.
8.	EP Integration and Test	Process and organization for conduction the Integration and Test of EPs.
9.	EP Resources	Description of the present workstations and networks available for EPs
10.	Evaluation Process	Description of the process to be used for eliciting comments on the EPs
11.	EP Maintenance and Operation	Describes the M&O tasks of EPs and the responsible organizations.
	Acronym List	

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2. EP Process

2.1 Evaluation Packages Overview

The ECS Team has defined a multi-track development approach that includes an incremental development track that will build the full functionality of portions of the ECS in parallel with formal-track development of other portions of ECS. Evaluation Packages are the early delivery mechanism that allows portions of ECS functionality (incremental and prototype) to be placed in the hands of selected users for evaluation and design iteration in advance of formal system releases. Evaluation Packages bring together increments and prototypes for deployment and evaluation (Figure 2-1)

Evaluation Packages (EPs) provide predefined dates for delivery of individual increments and selected prototypes (Figure 2-2). The planned content of each EP delivery is documented in this white paper. The feedback from one EP influences the objectives and design for the next. Each EP builds upon and expands the capabilities of previous EPs, until the last EP in the series supporting a formal release, when the software is migrated to the formal track for integration, acceptance testing, and formal delivery.

Each EP may incorporate selected prototyping efforts from the ECS segments or from external efforts. Prototypes are selected for inclusion in an EP primarily based upon their function and content and their relation to the goals of the EP, and on their need for evaluation by multiple users in the community.

In the EP7 and post-EP7 timeframe, part of the EP process is the merging of the incremental onto the formal track. This preliminary migration or transition to the formal track will begin to occur in the Release B CDR timeframe with the Data Management subsystem presentation of its' detailed design.
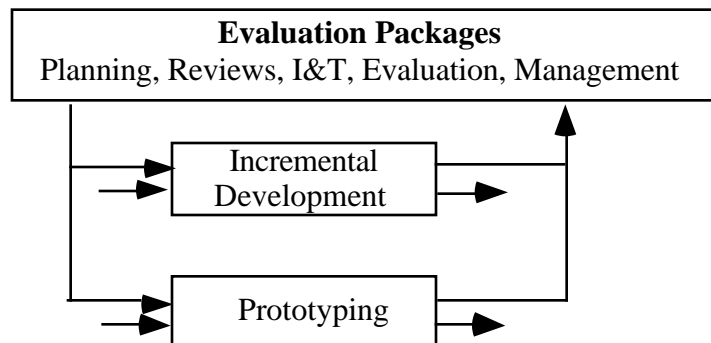
Figure 2-1. Evaluation Packages: Delivery Mechanism of Increments and Prototypes

Section 2.1 provides the summary EP Schedule and Milestones (Section 2.1.1) along with overviews of Incremental Development (Section 2.1.2), ECS Prototypes (Section 2.1.3), External Prototypes (Section 2.1.4) which includes discussion on the influence of external (non-ECS) prototypes on the incremental track and the new testbed facility in Landover . The EP Process (Section 2.2) describes the process by which increments and prototypes are brought together to form EPs. This section includes discussion on the transition to the formal track.

2.1.1 EP Schedule

Key activities and milestones associated with the overall Evaluation Package process leading to Release B are shown in Figure 2-2 and Table 2-1. The EP Schedule reflects a maturing of the EP process requiring more complexity to meet the various needs which EPs satisfy. In particular, are two items: 1) the addition of SPDS EP Workshops and 2) the transition of incremental software to the formal track. The SDPS EP Workshops are the result of the desire to feed comments on an EP directly into the next EP. In order to get the direct feedback and to provide the user evaluation needed for the incremental development, SDPS EP workshops have been added. These workshops allow collection of user evaluation with direct developer assistance, thereby avoiding the more rigorous I&T required for and EP deployment and independent evaluation. The transition to the formal track begins with two pivotal milestones: Release B CDR (for Data Management Subsystem) and the Post-EP7 Design Review (for Client Subsystem). The transition to the formal track is complete prior to Release B TRR.
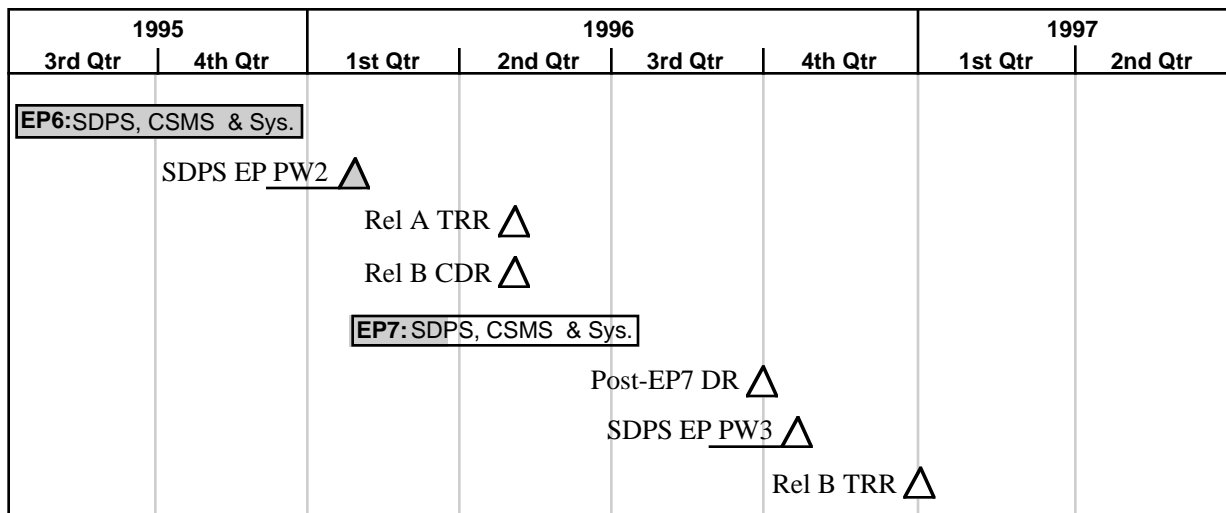
Figure 2-2. EP Schedule Leading to Release B

Table 2-1. Key EP Events Leading to Release B

Event	Date
EP6 Development (CSMS, SDPS & System)	
- EP6 Objectives Review (DOR)	06/20/95
- EP6 Design Review (DR)	08/04/95
- EP6 Test Readiness Review (TRR)	10/13/95
- EP6 Consent to Ship Review (CSR)	11/09/95
- EP6 Evaluation Readiness Review (ERR)	11/17/95
EP Prototype Workshop 2 (SDPS)	01/96
Release A TRR	04/96
Release B CDR	04/96
EP7 Development (CSMS, SDPS,& System)	
- EP7 Objectives Review	02/16/96
- EP7 Design Review	03/20/96
- EP7 Test Readiness Review	05/15/96
- EP7 Consent to Ship Review	06/26/96
- EP7 Evaluation Readiness	07/17/96
Post-EP7 Design Review (Client Subsystem)	09/96
EP Prototype Workshop 3 (SDPS)	11/96
Release B TRR	12/96

2.1.2 Incremental Development Overview

Incremental development is described in detail in Section 8 of the ECS Systems Engineering Plan (ECS Document 194-201-SE1-001, June 1994). A terse summary is provided here to aid the understanding of the EP Process in Section 2.2.

Instead of a single waterfall of sub-phases, the incremental process uses multiple incremental development cycles, including user evaluation prior, to integration with formally developed software. Figure 2-3 illustrates how multiple incremental development cycles support a release. The number of increments shown in Figure 2-3 is illustrative with the specific number of increments for a release based on specific release plans.

The incremental development approach involves a small customer selected segment of the user community in the process of product evaluation. Capabilities are demonstrated frequently in a "build and test a little, evaluate a little" development progression. Software built in one increment supersedes and provides more capabilities than the software in the previous increment. The incremental development process leads up to the integration of incrementally developed components into a formal release via conformance to design standards and the migration of documentation into the formal process.
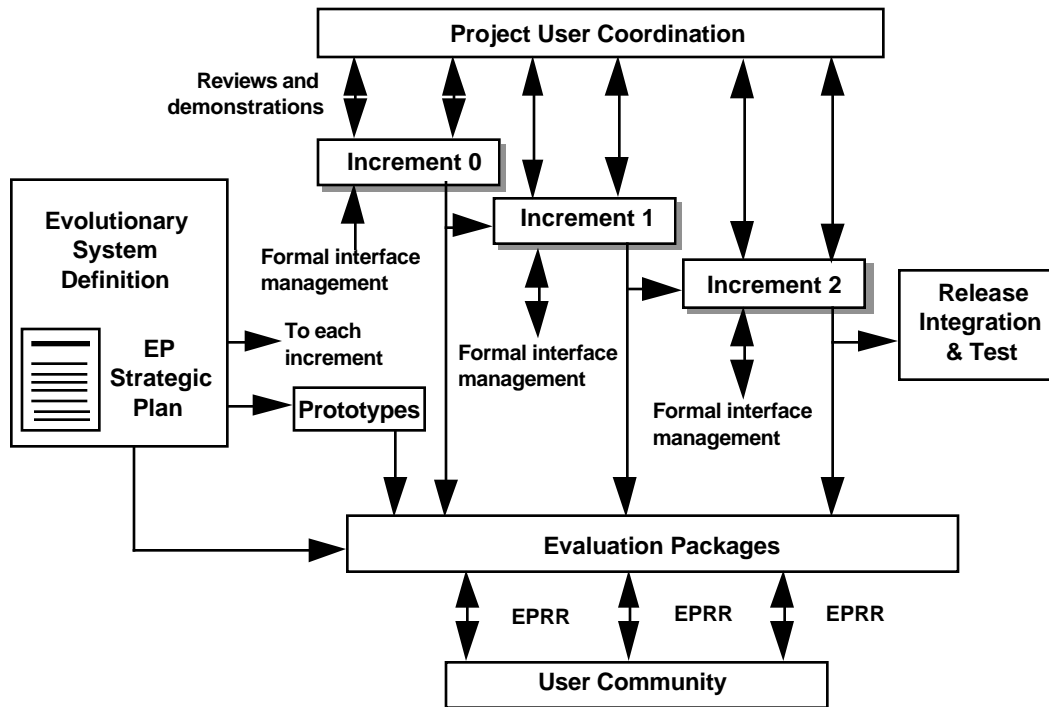
Figure 2-3. Incremental Developments for a Release

A single incremental development cycle has stages similar to those found in formal development (see Figure 2-4). An incremental development cycle is composed of the following stages: 1) Objectives Definition, 2) Design, 3) Implementation, 4) Integration and Test, 5) Maintenance and Operations, and 6) Migration. Incremental development starts with objective definition and Level 3 requirements trace, generally corresponding to requirements development in the preliminary design stage of formal development.

Both incremental development and formal development have design, implementation, integration and test, and maintenance and operations stages. However, the contents of each of the above cycles differs between formal and incremental development due to the iterative nature of the incremental track. In particular, documentation generated during incremental development is initially produced in a more streamlined fashion, e.g., in development "notebooks" maintained by developers, in white papers, in briefing charts, and in system demonstrations. Also, reviews are accomplished as a part of regularly scheduled coordination meetings.

Objectives notebook developed during Objectives stage shall be developed in accordance with the ECS Project Instruction for Incremental Track Objectives Folder (Draft PI, Number to be assigned).
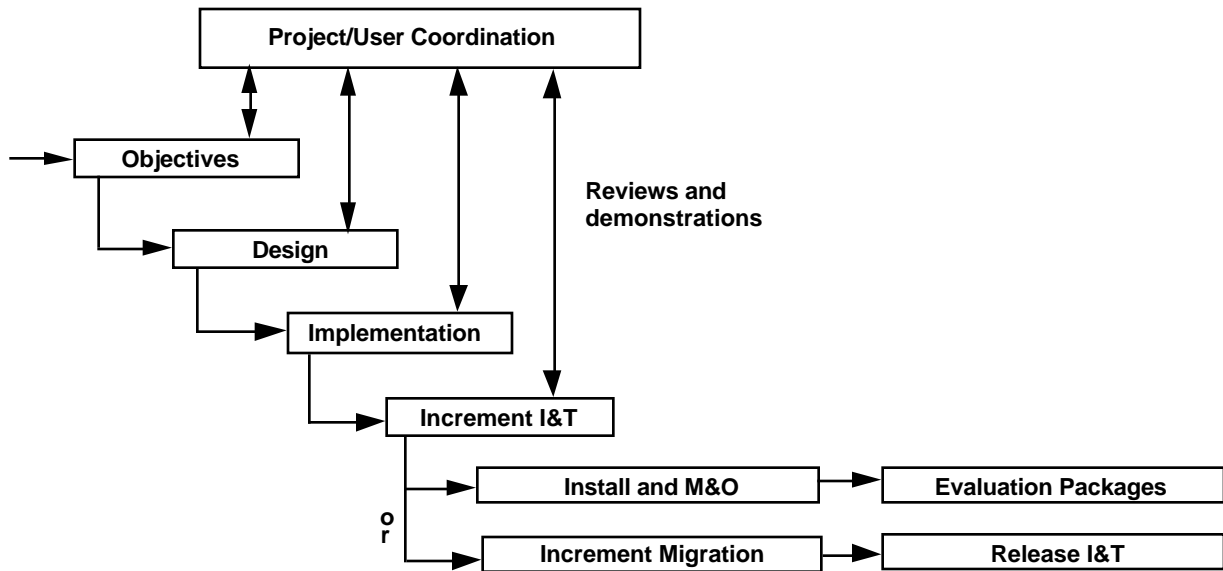
Figure 2-4. Incremental Development Stages

Other folders developed on the incremental track may be in the format of white papers, briefing charts, or annotated charts, available electronically or hard copy, as appropriate to convey the information. To allow for ease of generation of formal documentation, priority is given to using a template during the increment that is in the formal documentation format

Peer Reviews conducted during the Design stage shall be conducted in accordance with the ECS Project Instruction for Inspections and Reviews (PI Number SD-1-004).

2.1.3 Engineering and EP Prototypes

Prototypes which are utilized for EP purposes may be of two types: 1) Engineering Prototypes and 2) Development Prototypes. Engineering Prototypes are developed in accordance the ECS Prototyping and Studies Plan (ECS Document 194-317-DV1-001, May 1994). Development Prototypes for EPs follow a similar process with one major exception: this EP Strategic Plan White Paper is used as the planning record instead of the Prototype Database defined for Engineering Prototypes. A terse summary of the prototyping process is provided here to aid the understanding of the EP Process defined in Section 2-2 (see ECS Prototyping and Studies Plan for a complete description).

Figure 2-5, Prototypes and Studies Process, shows the identification, selection, execution/ evaluation and incorporation steps of the prototypes and studies for Engineering Prototypes on the ECS project. Identification is the process of proposing a prototype or study for implementation. Selection is the process of reviewing the prototype and study proposals for approval by the Prototype Review Board or ETMs. Execution/evaluation is the process of implementing the prototype and reporting on the progress of prototype activities to the project. Incorporation is the process of feeding results back into the design and implementation process in the most effective manner. Table 2-2 provides a summary description of each step.

IDENTIFICATION

Technology Assessment →
RRDB Screening →
Risk Management Panel →
Science Office →
Solicited and Unsolicited → Proposals

Prepare Proposal

Enter into DB
Prototype Administrator

Prepare Summary Report
Prototype Administrator

SELECTION

Forward Proposals
Prototype Administrator

Optional Independent Slection Recommendation

Assess proposed ptototype against predefined selection criteria and make recommendation.
Segment Manager

Approve Selections

EXECUTIVE/EVALUATION

Day-to-Day Management

Maintain Status

Prepare Progress Reports

Enter Status In DB
Prototype Administrator

Prototype Evaluation

Optional User Input →

OPTIONAL INCORPORATION STEPS

Prepare White Papers

Perform Demonstration

Report at PDR/IDR

Optional →

Integrate into EP

Figure 2-5. Prototypes & Studies Process

Table 2-2. Prototype Process

Step	Description for Engineering Prototype	Description for Development Prototype
Identification	• Short proposal (one to two pages) prepared by organization proposing the prototype • Prepared in accordance with Prototype and Studies Plan (317/DV1) • Submitted to Prototype Administrator for entry into prototype database	• Modified version of the Objectives Folder which documents areas of uncertainty in the design of the component
Selection	• Prototype Administrator forwards proposal and funding source to selection review personnel • Approval authority determined by funding source • participants to implement and evaluate the prototypes are listed	• Proposal reviewed at EP Objectives Review • Participants and implementers determined by EP process
Execution/ Evaluation	• Prototype Lead responsible for managing day-to-day tasks • Quarterly Prototype Status Reports in conformance of DID 318/DV3 • Status prototype maintained by Prototype Lead and forwarded to the DTR and Prototype Administrator • User involvement through demonstrations and inclusion into EPs where appropriate	• Segment EP managers responsible for managing day-to-day tasks • Status part of EP Life Cycle Reviews (see section 2.3) • User involvement through EP process
Incorporation	• Determined by Development Team Representative and Evaluation Team Leader • If prototype results are to be used in ECS implementation, a complete set of required documentation and testing must be accomplished to support the requirements of the incremental or formal development track.	• Determined by Development Team Representative and Evaluation Team Leader • Documentation for incremental development developed as part of EP cycle in which the prototype becomes an increment

2.1.4 External Prototypes and their relationship to the the EP Process

As part of the EP process, ECS evaluates external prototypes for inclusion in ECS development. External prototypes are those that are funded by ESDIS, NASA or other EOSDIS community interest. ECS and ESDIS continually evaluate and provide guidance to the prototyping community in order to maximize the technology transfer effort into ECS. The Prototypes and Studies Steering Committee (composed of ECS and ESDIS personeel) serves to provide guidance in this regard, as well as provide guidance into the EP objectives. This ensures overall coverage of the link between the community and ECS as it pertains to new technology development.

The practice of including external prototypes in incremental track events has already yielded postive results. The UMCP (Univ. of Maryland, College Park) Dynamic Query prototype was evaluated as a part of PW2 with considerable success, resulting in the influence on the look-and-feel of the Java Earth Science Tool (JEST) prototype and the ESST. In addition, the V0 WWW IMS was evaluated as the forerunner to an ECS Web Client for earth science search tool functionality. External prototyping has and continues to provide important inputs into incremental track functionality. To formalize and support this process further, ECS is developing the ECS Technology Transfer Testbed (ET3).

2.1.4.1 ECS Technology Transfer Testbed

Introduction

In order to properly evaluate key technologies and protoype systems from sources other than ECS, ECS has created an ECS Technology Transfer Testbed (ET3) facility which will support two way technology transfer to and from the EOSDIS program. Beginning in early 1996, the Testbed will begin hosting demonstration prototypes of both ECS and NRA/CAN research. By mid 1996, the Testbed facility will be operable as a low power replica of a DAAC environment, and will model the major DAAC data management subsystems: data server storage, ingest and scientific data processing, the user environment, and the DAAC data management and control processes. The Testbed will make available specifications of the DAAC's open interfaces to researchers who want to build compatible technologies, and will be capable of simulating DAAC processes to evaluate the potential contribution of new technologies to the EOSDIS program.

Objectives

The ET3 will provide access to a variety of ESDIS projects which demonstrate one or more key features that may be applicable to the ECS environment. More specifically, the ET3 will:

- provide a two way conduit for technology transfer:
  - external research, into ECS development
  - ECS into the NRA/CAN research community;
- provide an environment for demonstrating results of ongoing research, technology and results produced by the NRA/CAN and ECS;
- provide a center for public access to technical specifications, datasets, documentation and services which will help researchers provide capability to interface to the ECS;
- provide a realistic demonstration and test environment which will support development of technical analysis of suitability for technologies to be inserted into ECS.

Operating Concept: Technology Evaluation

The operations concept of the ET3 follows a multi-level plan (see Figure 2-7 below). Essentially the first phase of the plan calls for the initial infusion of key prototypes from the research community (NRA, CAN, ECS Collaborative, etc.) into the actual Testbed. Here ECS is

responsible for setting up the proper operating environment for each prospective prototype. The second phase involves the actual review by the ET3 committee. The criteria for ECS review include a review of cost, match to ECS requirements, evolvability, risk reduction, scalability and maintainability. For certain prototypes further studies may be needed to investigate other issues

The third phase is the appraisal. After the review is completed per prototype, one of three possible outcome paths is assigned. A prototype can be found to be worthy of further prototyping and expansion within a PW or EP, considered critical enough to bypass the incremental track and move directly onto the formal track, or be found to be not suitable for ECS needs. Unsuitable prototypes may be considered for further analysis depending on the outcome of the review.

Scope of Operations

The ET3 will provide three facilities:

Demonstration Center. Facility where technology developed by ECS, ESDIS, NRA/CAN and others can be hosted (or linked) and made available for both scheduled and unscheduled demonstrations.

ECS Technical Reference Public Library. Public reference library of technical information related to the interface between ECS and NRA/CAN research and development. Available over the Web; accessible form EDHS home page and from the ECSInfo home page. Contains ECS API documentation, Test Datasets, and demonstration database.

Technology Evaluation Facility. Facility for obtaining a controlled evaluation of technologies which may be suitable for use in ECS. Facility will have an environmental configuration which is well defined and documented, and reference datasets available as test drivers. Staff will be capable of providing technical interface to researchers seeking evaluation; and, producing technical reports on technology suitability for further ECS/ESDIS evaluation.

EP Relevance

The ET3 facility will support a more rigorous evaluation of external prototypes for inclusion in an EP. Plans are already underway to install 6 candidate prototypes picked from the NRA/CAN and ECS Collaborative Prototype Programs. These candidate prototypes will be hosted at ECS and put through the three phase plan described above. Most of these candidate technologies have been targeted for the Release C time frame, however, several will be reviewed against Release B requirements and included as potential prototypes for PW3.

ECS Technology Transfer Testbed: Concept

Other Prototypes

NRA/CAN Research

Test/Demo Plan
- test/demo objective
- test scenarios
- testbed resource utilization

Testbed
- Demo
- Test

Modeling and Analysis *
- life cycle cost
- scalability
- maintainability
- persistance

Technology Assessment

ECS Benefits Analysis   **Sustainability**
- cost and schedule
- requirements
- evolvability
- risk reduction

ECS Insertion Analysis
- architecture
- schedule

Not Suitable

PW or EP

Formal Track

* Modeling and Analysis studies are funded by NASA on an as-needed basis.

Figure 2-6. ECS Technology Transfer Testbed (ET3): Concept

2.2   EP Process

EPs are a delivery and evaluation mechanism for incremental and prototype developments. The discussions which follow speak of the "EP process" for uniformity in this paper, but it must be remembered that the incremental prototype products are the items of development. The EP process provides an integrating and complete life cycle structure for the prototypes and increments.

The challenge for EP life cycle design is to provide just the necessary amount of structure without creating an administration overload that totally removes the freedom to react to objectives and design changes dictated by evolving circumstances. That challenge has been accomplished with the design of an EP life cycle that adopts selected practices from more traditional engineering methods, and applies them on the rapid prototyping form originally intended. These include the following features:

- Objectives setting and review.
- Design coordination and review.
- Documentation in Program Development Folders.
- In-process demonstrations and peer reviews with feedback to adjust implementations.
- Frequent EP team status assessments and planning adjustments.
- Early participation of test personnel in product testing.
- Progressive, semi-formal, integration and test.
- EP Consent to Ship Reviews.
- EP Evaluation Readiness Reviews.

Experience to date indicates that the minimum time to produce meaningful content in an EP is about six months, and that evaluation of the EP will require an additional two months including time for data analysis and results sharing. The actual time for a given EP will depend upon the defined content of that EP.

The structure of each EP life cycle is shown in Figure 2-6, EP Life Cycles. A time scale in weeks and months from start date provides a relative time reference to events. The duration of the cycle for each EP is minimized by parallel design prototyping with more formal design work, and by overlapping the evaluation period of the first EP (EPn) with the start up of the next (EPn+1). Extra discipline must be applied in the latter instance to assure that the evaluation results from EPn actually do make maximum contribution to the evolution into EPn+1.

EP n

P = Weekly Planning Session

WAT = Wide Area Teleconference

EP n+1
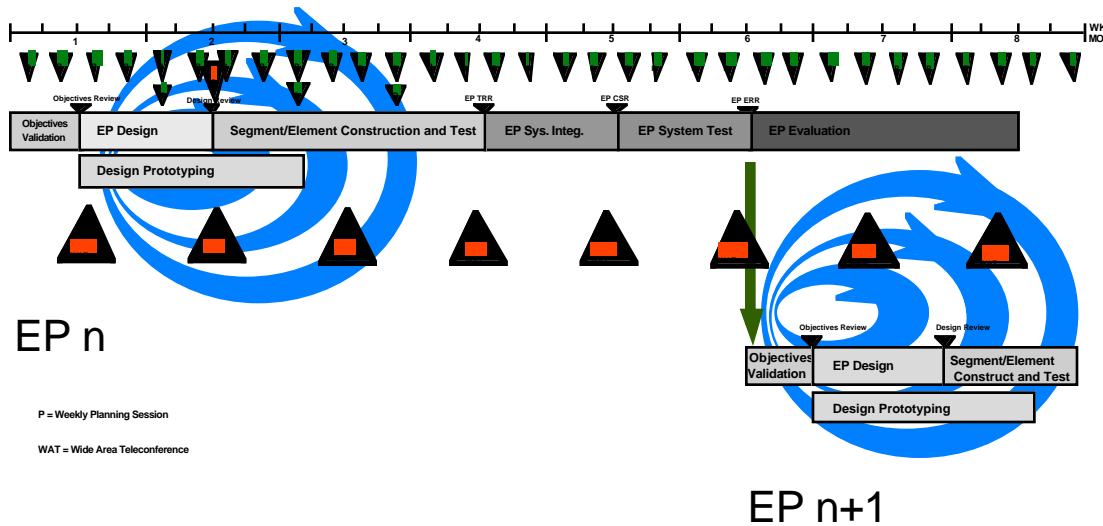
Figure 2-7. EP Life Cycles

Maximum visibility into the EP process for all interested parties is our goal, and participation by ESDIS, DAAC, and user personnel is encouraged. The following activities are included in the EP Life Cycle design to afford the visibility desired.

- EP Planning and Coordination Sessions - Weekly discussion of status against plans, accomplishments, problems encountered, and near-term activities for each EP participant.

- Wide-Area Telecons - Teleconferences, including interested personnel, of monthly reviews of status against plans, accomplishments, problems encountered, and mid-term activities for each EP participant. Emphasis will be placed on larger issues of interest to the broader scope of participation.

- Demonstrations - Informal, as well as more structured, demonstrations of accomplishments to date will be included in the EP process to afford every opportunity for customer and user input to the evolving design implementations. Informal demos can take place whenever a significant new level of changes has been implemented and can occur whenever personnel are available to conduct and view the demos. More structured demos will be planned at key points in the life cycle where they make sense for the items being developed. As a minimum, structured demos will be included in the Semi-Formal Reviews conducted in the later stages of I&T.

- Semi-Formal Reviews - The EP life Cycle includes sufficient management control to assure that EP developments follow agreed to methodology and standards, make acceptable progress toward agreed to functionality and schedules, and that the products deployed include the quality required in ECS products. This control is offered through semi-formal reviews. They are "semi-formal" in that they entail no advance hardcopy, use relaxed-format presentation materials, have no RID process, and no compulsory

attendance list (except for developers). These reviews include an informal Objectives Review, Design Review, Consent to Ship Review, and an EP Evaluation Readiness Review. Each is described in purpose and content below.

- Peer Reviews - EP developments are performed in a small-team work group environment with daily interaction and informal coordination of designs, implementation requirements, and accomplishments Ad Hoc technical interchange discussions are a normal part of this process and assist the coordination process. More structured peer review and coordination sessions are called by EP management whenever issues are uncovered by this process or in the weekly planning and coordination sessions.

- Segment ETM Status Meetings / demos - Each segment has its customer counterpart and established review meetings. EP accomplishments are routinely reported and demonstrated in these forums with pointed focus on the special concerns of each segment.

Each of the phases of the EP life cycle, shown in Figure 2-6, is described below.

2.2.1 Objectives Validation

The development cycle of each EP begins with a review of the previously defined goals and objectives for the EP (as documented in the current version of this paper). Goals and objectives are updated with lessons learned from recent EP development and test activities, and with results coming from the evaluation of the EP currently in evaluation. The main items to be revalidated include:

- EP Objectives - The purposes to be achieved by deploying the services at this time, as contained in the EP Strategic Plan.

- Incremental Questions and Metrics - Detailing of EP Objectives as contained in the Incremental Objectives Folder.

- Process Objectives - The development management and administrative process objectives that are to be explored in the EP.

- Process Capabilities - The detailed process procedures to be implemented to achieve the process objectives.

- EPn COTS Requirements - Definition of the COTS hardware or software required to implement the EP, assurance of its availability, or initiation of its procurement.

2.2.2 Objectives Review

A semi-formal review involving ESDIS, ECS Science Advisors, DAAC representatives, all developers, test and integration, and support functions. Proposed goals and objectives for the current and projected EPs are presented, discussed, and agreed upon. Agreements are documented following this review and published in an update to this paper.

2.2.3 Design

Design Process - Decomposition of functions into units of architecture (functions - threads - builds - modules / objects, etc. as appropriate), and identification and definition of interfaces therein.

Design Prototyping - coding of elements of functionality for early experimentation with implementations.

Design Documentation - Development Folders

- Interface Control Documents

- COTS Requirements Table (specs)

2.2.4 Design Review

The EP Design Review is a semi-formal review involving ESDIS, ECS Science Advisors, DAAC representatives, all developers, test and integration, and support functions. Proposed designs for the items included in the EP are presented in vugraph form, discussed, and agreed upon. Agreements are documented in updates to the presentation vugraphs and included in the development folders following this review. A collected set of updated and commented presentation materials is published for all participants and becomes the design baseline for the EP.

Peer Reviews conducted during the Design stage shall be conducted in accordance with the ECS Project Instruction for Inspections and Reviews (PI Number TBD).

2.2.5 Construct and Unit Test

Construction of software begins with approval of designs and interface definitions. Software is written to ECS software standards to assure reusability with little rework. All modules are created, updated and maintained under the ECS software configuration management system. The build/thread methodology is followed to create and integrate modules in meaningful sequences building toward the design functionality intended. At the point where predefined threads have been successfully tested to allow the integration of those threads into a Build, an informal TRR is held to transition software ownership from developer control to EP Integration and Test Organization control. This is accomplished by "promoting" the modules in the CM library. Design changes, which were encouraged for evolution until this point, are ended at TRR.

2.2.6 Design Freeze

Design changes must be suspended in even the most free development environment at some point in time to establish a stable baseline for test and integration of multiple system components. The design freeze for EP software occurs at the TRR associated with transfer of CM control from development to EP Test. Subsequently, the only software changes allowed are to fix recorded discrepancies.

2.2.7 EP Integration and System Test

EP integration and system test are performed in two phases divided by a Consent to Ship Review. Activities in these phases are performed by the EP I&T group made up of personnel from the I&T organizations of the segments and the SI&P Office. Leadership of the group rotates with each EP. Configuration management responsibility for this phase belongs to the test group, and a formal Discrepancy Reporting (DR) tool is used to prioritize and track problems discovered. Daily activity review and planning sessions, overseen by EP management, and attended by test, and development people, are held during this phase.

> EP Integration - Integration is performed at the EDF, bringing together the software builds from the elements and segments, in the specified computing and communications environment, into a functional whole.

> Consent to Ship Review - This review is held when the integration testing indicates that the EP is functioning well and all DRs which might compromise its operation have been resolved. The purpose of the CSR is to demo the system to ECS, ESDIS and DAAC representatives, to review the test status with them, and to obtain approval to move the EP to broader visibility by installing it at the DAACs for system-wide testing.

> System Test - The system test period includes EP installation and check out by the test group, training and familiarization of the DAAC liaisons and staffs, and a system-wide exercise of the EP with all DAACs participating. The purpose of the system exercise is to assure the soundness of the EP under multi-user loads and to demonstrate readiness to support the EP evaluation phase.

2.2.8 EP Readiness Review

The EPRR is conducted at the end of the system-wide exercise to review occurrences in the exercise. If it was successfully concluded (no unexplained, or priority 1, (show-stopper) problems), the EP is declared ready for use in the evaluation environment by its intended evaluators.

2.2.9 Evaluation

EPs will be evaluated by three user groups with data collected via three evaluation methods. The three user groups are science users, operations and users services, and ECS developers. The three evaluation methods are Usability Testing (UT), and Evaluator Preference Survey (EPS) and API evaluation. Each of the user groups and the evaluation methods are described in Section 10.

The life cycle for an EP is completed as its evaluation is finished and the results from that evaluation feed into the beginning phase -- Objectives Validation - of the next EP. The first EP remains installed at the DAACs during the Development *and Test?* phases of the next EP to continue evaluative use in that user environment. Feedback continues to influence the development of the next, and later generation, EPs.

2.3   Post-EP7 Transition to Formal Track

Eventually, even incremental track components must be formally developed. This section outlines a preliminary plan for the transition activities. This plan, will most probably undergo modifications after the release of this document and prior to Release B CDR.

In the EP7 timeframe, there are two subsystems remaining on the incremental track for Release B: Client and Data Management. For client, the transition begins in the post-EP7 timeframe with the initial event being the Post-EP7 Design Review. For Data Management, the transition actually begins at Release B CDR where DM will present a detailed design for review. For each subsystem, transition activites will result in formal design to be presented at key reviews and unit tested code by or prior to Rel B TRR.

2.3.1   Client Subsystem Transition to Formal Track

Formal Track

 Towards the last quarter of 96 CLS-B will baseline its design (DID 305) and requirements (DID 304) in preparation for the Release B TRR code hand-off to I&T. CLS-B code drops to the first phase of I&T will be kept to a minimum due to the ongoing incremental track development and test (EP7) occurring at that time. Phase two of I&T will include the bulk of the Release B Client hand-off.

Incremental Track

Primary focus is the design, development and deployment of EP7. EP7 ERR represents the last incremental track milestone for Release B CLS. It is anticipated that the CLS baseline design will be presented shortly after PW3, hence only minor design changes will be retrofitted into the baseline at that point in time.

Prototyping Track

A few prototypes will be deployed for evaluation during the EP7 timeframe. Feedback will be funneled directly into the CLS-B design efforts (formal track) and in certain cases to PW3 (incremental track).

Migration to Formal Track

Two main milestones provide lower and upper bounds for this activity: EP7 ERR which represents the completion of the CLS-B incremental track and Release B TRR. During this period issues and feedback from the prototypes and increments will be translated into formal design and requirements. A working group is being established as the primary focal point to coordinate these activities. User task analysis and usability evaluations will be part of the working group charter in order to apply HFE concepts as early as possible into the design process.
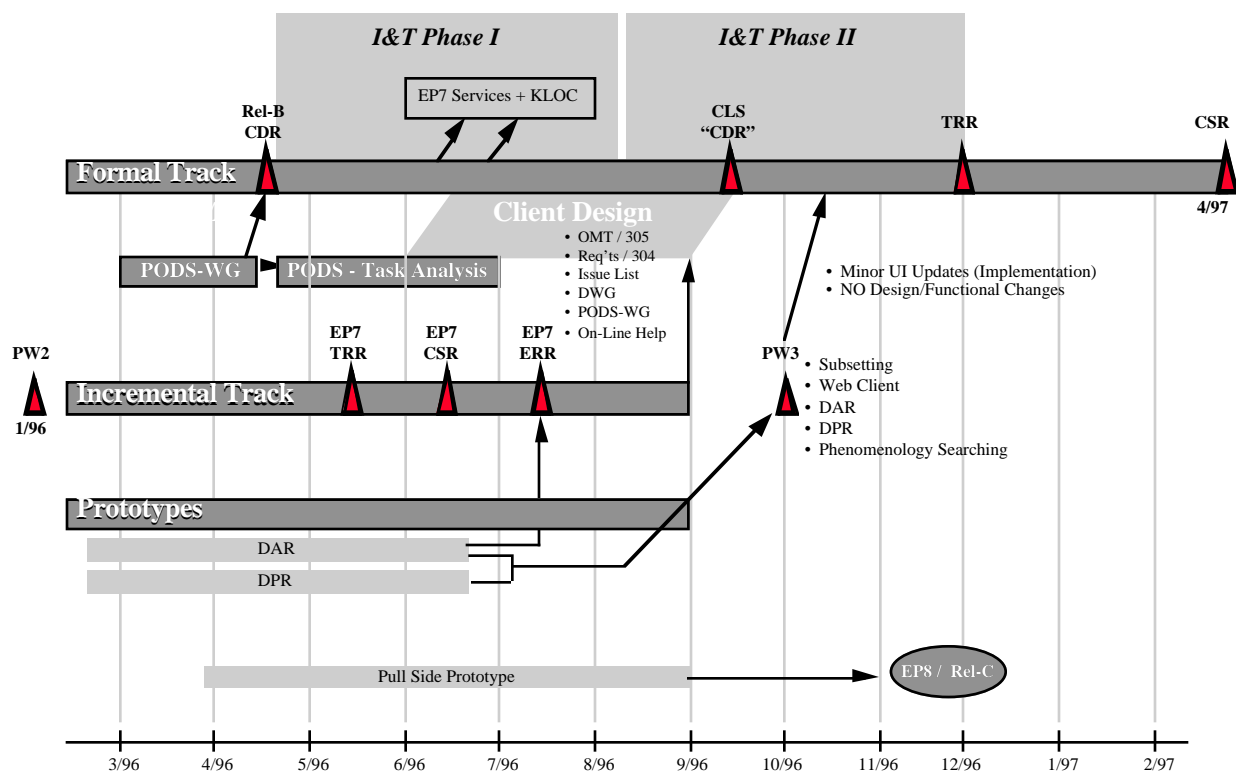
Figure 2-8. Client Transition to Formal Track

2.3.2 Data Management (DM) Subsystem Transition to Formal Track

Formal Track

DM is baselining its' design (DID 305) and requirements (DID 304) in preparation for the Release B CDR. DM will build on EP7 code for a drop to the first phase of Release B I&T (August). A subsequent drop that addresses feedback from EP7 and PW3 will occur for the second phase of Release B I&T prior to TRR (December)

Incremental Tack

There are two remaining events for DM: EP7 and PW3. For EP7, the focus is design and development of Data Dictionary, V0 Gateway, and LIM increments. The PW3 DM components will come from the Release B Phase 1 development, which will include the EP7 functionality, plus support for Earth Science Query Language, phenomenology and climatology related searches, and other request types in addition to browse and acquire, such as subsetting. Feedback from either of these events will be evaluated as changes to the Data Management Release B baseline or for inclusion in Release C.

Prototyping Track

Currently, there are no remaining or planned prototypes for Data Management in the transition timeframe. External prototypes, such as UAHs' subsetting prototype are currently being evaluated for inclusion in PW3 with a possible impact on the DM-B baseline.

Transition to Formal Track

PW3 represents the conclusion of the incremental track for DM. During the period between Release B CDR and the wrap-up for PW3, issues and feedback will be evaluated against the baseline established in the reviewed DID 305.
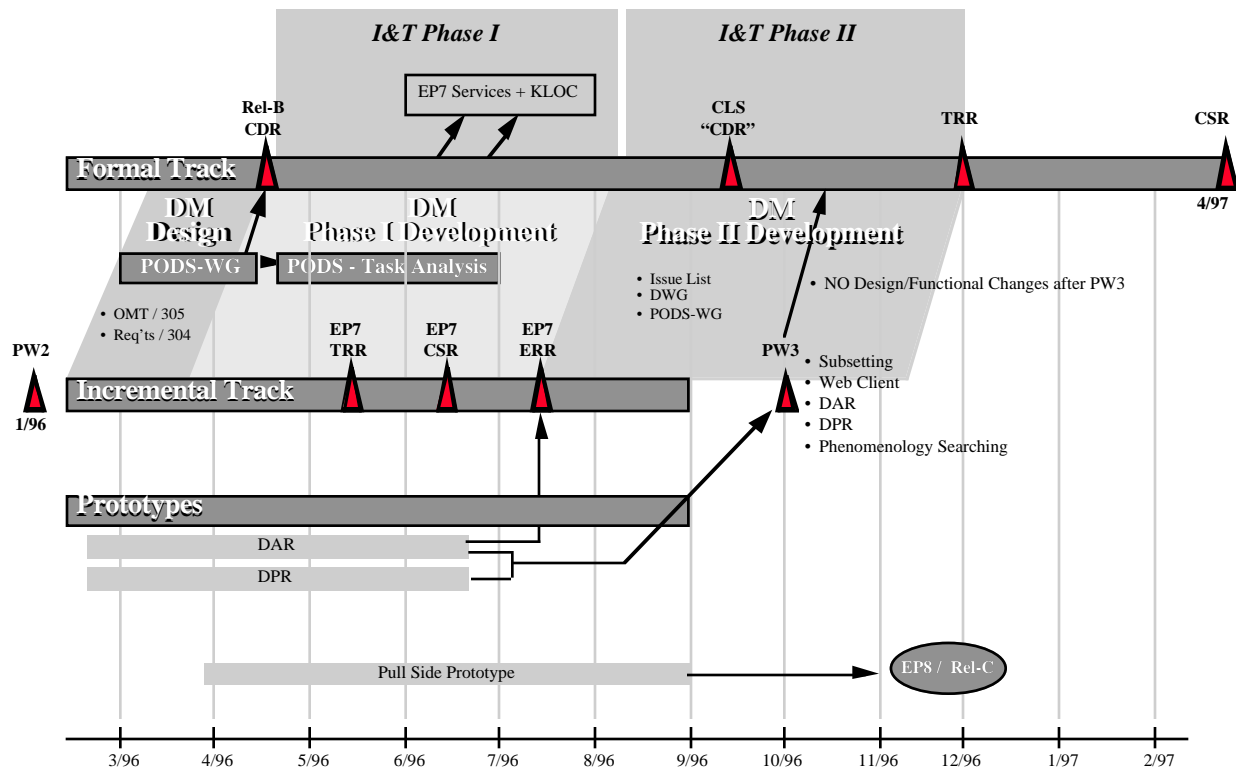
Figure 2-9. Data Management Transition to Formal Track

3. EP Strategy

EP Strategy was developed using a subset of the content required for Release B and by the needs of the incrementally development items for user evaluation. This section provides the link to the ECS Release Plan with respect to the content suited to EP evaluation and incremental development (Section 3.1). Additional considerations for EP content are based on incremental development by segments (Section 3.2). An overall summary of the EP strategy includes the content provided by each segment, associated data and evaluation (Section 3.3).

3.1 EP Strategy Development

3.1.1 Formal Releases Drive EP Planning

This strategic plan documents the objectives and deployment of the EOSDIS Core System (ECS) EPs identified in the ECS Master Schedule supporting ECS Release B. EP Strategy Formulation described in this section is based on the a subset of the functionality defined for Release B in the ECS Release Plan (Figure 3-1). This section explains how specific driving requirements for ECS development relate to the EP strategy.
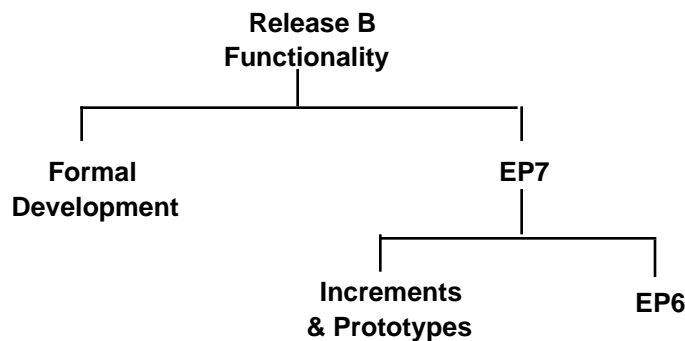
Figure 3-1. EP Strategy Formulation

3.1.2 Guidelines: Formal vs. Incremental Development

Purposes of the formal and incremental development tracks is stated in the ECS SOW as follows:

Incremental Development may be used for those areas of the system where requirements are less well understood and iteration of requirements and design is anticipated with user evaluation. Formal Development shall be used where requirements are more mature and stable. Incremental development may also be used in COTS intensive parts of the system and to develop system infrastructure in support of other incremental developments.

Also from the ECS SOW is the purpose of the Evaluation Packages:

Evaluation Packages are a delivery mechanism for early deployment of Incremental Developments and selected Prototypes. The purpose of the Evaluation Packages is to solicit user evaluation early in the development cycle.

It is with these guidelines in mind the that the strategy for EP is formulated in the next sections.

3.1.3 Release Plan as basis for EP Strategic Planning

The basis for EP Strategic Planning is the ECS Release Plan. The ECS Release Plan has the following structure and logic:

- Identification of External Driving Requirements (Section 5)

- Assignment of the Driving Requirements to Releases (Table 7-2)

- Identification of the Segment Functions needed to satisfy the Driving Requirements (Section 6 Tables)

- Detailed Identification (Service Class level) of Segment Services by Release (Section 10)

The structure and content of the release plan is used to determine driving requirements for the EPs in the following steps:

- Based on Section 5 of the Release Plan and the guidelines listed in the previous section of this white paper, Identify the External Driving Requirements which have "Uncertainties"

- Based on the previous step and the allocation of driving requirements to release (Table 7-2 in the Release Plan), Identify Release B, "Uncertain" Driving Requirements. (The results of this step are listed in the next section of this white paper.

- The Release B, "Uncertain" Driving Requirements are then an input to the segment planning for incremental and prototype developments which along with development considerations were used to develop Tables 5-1 and 6-3.

3.1.4 Release B, "Uncertain" Driving Requirements

The items listed in Table 3-1 are the result of the EP Strategic Planning process described in the previous section. These are a subset of the overall ECS External Driving Requirements for Release B. The complete list is in the ECS Release Plan.

The items in Table 3-1 can be found in the SDPS Strategy, Table 4-1, with the exception of V0 Data Migration. V0 Data Migration is a separate task being conducted by the ECS contractor. EPs are dependent upon V0 Data Migration as described in Section 6.

Table 3-1. Release A & B, Driving Requirements

V0 Interoperability
Cross DAAC Coincident Search
Search Using Combination of Logical Operators
Display of Data Timeline
Search on Attributes across DAACs & Data Sets
Results from Search across DAACs & Data Sets
Simultaneous Display of Multiple Browse Data
Automated Authentication for Data Distribution
API for Update, Query and DBA Utilities
Data Visualization Capabilities
On-Line user Survey at all Sites
Multiple DAAC Orders
V0 Data Migration

3.2   Incremental Development

Although, determination of which elements of ECS are best suited for incremental development is based on requirements volatility, it is subsystems which are developed incrementally not requirements. The state of the requirements and the anticipated interaction with users with respect to the requirements provides indications to which portions of the system are best suited to incremental development. The choice of what is developed incrementally is done on a system partitioning basis, e.g. subsystem by subsystem basis. With respect to EP strategy, selecting subsystems to be developed incrementally means that there is additional EP content beyond the content based solely on requirements uncertainty (see Section 3.1). Additional issues concerning development, e.g. timing of critical prototypes and COTS selection, are discussed in Section 4.1 for SDPS and 5.1 for CSMS.

A summary of the development approach and support of EPs by ECS subsystem is shown in Table 3-2. The main area of incremental development and associated EP evaluation, are those areas in most direct contact with the science users, e.g. SDPS client, Interoperability, Data Management. The Data Server will developed in part incrementally and the remainder using the formal methodology. This ambiguity is resolved at the next level below subsystems in the system partitioning. Although the CSMS subsystems ISS, CSS (now IDG) and MSS are developed formally, the EPs rely on support from these subsystems.

Table 3-2. Development Methodology by Subsystem

Segment	Subsystem	Development Methodology	EP Support (If not incremental)
SDPS	Client	**Incremental**	
SDPS	Interoperability	**Incremental**	
SDPS	Data Management	**Incremental**	
SDPS	Data Server	Formal	**Yes**
SDPS	Ingest	Formal	
SDPS	Planning	Formal	
SDPS	Data Processing	Formal	
CSMS	CSS	Formal	**Yes**
CSMS	ISS	Formal	**Yes**
CSMS	MSS	Formal	**Yes**
FOS	User Interface	Formal	
FOS	Planning & Scheduling	Formal	
FOS	Data Management	Formal	
FOS	Command Management	Formal	
FOS	Command	Formal	
FOS	Resource Management	Formal	
FOS	Telemetry	Formal	
FOS	Analysis	Formal	

3.3   Summary of EPs

This section provides an overview of the content of the EPs and EP Prototype Workshops. Table 3-3 summarizes the content for each segment, the associated data and evaluation methods. Detail on SDPS content can be found in Section 4. Detail on CSMS content can be found in Section 5. Detail on data sets for EPs can be found in Section 6. Detail on evaluation methods and evaluators content can be found in Section 10

Table 3-3. Summary of Content by EP (1 of 2)

	SDPS Content	CSMS Content	Data	Evaluations
EP4	- EOSView - Advertising Service - Scientist Workbench	- Network Management - Access Control Lists - DCE Encapsulation - Trader Service - Non-DCE user	- EDC & NSIDC Directory - DAAC Sampler for Browse	- Usability Test and Survey of Science Users - Usability Test of Operations Users
PW1	- Inventory, Guide, Directory Search (prototype)	(none)	(same as EP4)	- Usability Test of Science Users

Table 3-3. Summary of Content by EP (2 of 2)

	SDPS Content	CSMS Content	Data	Evaluations
EP6	- Data Type Service - Metadata Search - Browse - Acquire - Advertisement Creation - Data Dictionary - User Registration - User Preference Tool - Comment/Survey Tool - Integration of Tools	- Event Services - Management Services - Comment/Survey Server - User Registration Server - Asynchronous Message Passing	- GCMD in advertising + appropriate directories in Data Server (ERBE, ISCCP) - EDC Inventory - Subset of ERBE, ISCCP	- Usability Test and Survey of Science Users - Usability Test of Operations Users
PW2	- Fast results rendering - ECS to V0 Interoperability (search and results) - Multi Data Server Searches (LIM Prototype) - Web w/Java Prototype - UMCP Dynamic Query - V0 WWW IMS Prototype	(none)	- EP6 Data Server collections - Additional V0 metadata	- Usability Test of Science Users
EP7	- Guide search (single site) - Polygonal Search - Direct Browse - ECS to V0 Interoperability (browse and order) - LIM - DAR UI	- Mode Management Prototype - Comment/Survey Server Update - User Registration Server Update	- EP6 data - TBD	- Usability Test and Survey of Science Users - Usability Test of Operations Users
PW3	- V1 Web Client - Phenomenology Searching - DIM - DAR - DPR - Subsetting proto	None	- EP6 data - EP7 data - TBD	- Usability Test and Survey of Science Users

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4. SDPS Deliveries by EP

4.1 SDPS Development Plan Overview

The purpose of this section is to provide an overview of the SDPS plan for the incrementally developed components that will be released via an Evaluation Package (EP), as well as a plan for the prototyping components that will be released via an EP. The planned development process is more specifically defined in the following documents : the Software Development Plan for the ECS Project, the System Engineering Plan, and the Incremental Development Plans. This section will focus on the components destined for EP incorporation, rationale for development track allocation, and schedule and dependencies considerations.

4.1.1 SDPS Subsystems

The SDPS functions have been grouped into subsystems, which provide a method for a logical structure of the system design. Each subsystem is comprised of collections of related functions, which are in turn are organized into SDPS services. Each type of SDPS service consists of a set of software design objects. The ECS System Design Specification Section 4 details each SDPS Subsystem. An overview of each SDPS Subsystems/components that will be developed incrementally or prototyped for EP incorporation, and a brief description of each subsystem follows (see the System Design Specification (ECS Document 194-207-SE1-001) for more detail):

- **Client Subsystem**

    This subsystem provides the user interface to the SDPS. It consists of a Scientist Workbench and a Desktop Component. The Scientist Workbench contains various tools, and the Desktop provides convenient methods for organizing the user interface objects, and setting interface preferences.

- **Interoperability Subsystem**

    SDPS is architected as a collection of distributed applications. They use the functions of the CSMS Communications Subsystem and Internetworking Subsystem to cooperate with each other. The Advertising Service is the SDPS component of the Interoperability Subsystem.

- **Data Management Subsystem**

    This subsystem provides the functions which are needed to locate, find and access earth science and related data in the ECS databases and in data systems with which ECS interoperates.   This subsystem includes distributed search and retrieval functions called the Distributed Information Management (DIM) functions, components which act as each site's gateway into its earth science databases called the Local Information Management (LIM) functions, and a Data Dictionary (DD) function which users can access to obtain explanation of available data.

- **Data Server Subsytem**

    This subsystem provides the physical storage access and management functions for the ECS earth science data repositories. It can be accessed directly by other subsystems, or by the Data Management subsystem for distributed searching. At this point, all Data Server Service components are part of the formal track. EP7 will use the Release A Phase II Data Server to support the Data Server and Data Type service components.

4.1.2 Development Track Allocation

The SDPS subsystems/components that are allocated to the Incremental Development track are those where requirements are less well understood and iteration of requirements and design is anticipated, and those subsystems/subsystem components which will use COTS extensively. The Client Subsystem requires both DAAC and Science community iterative interaction to understand requirements and is expected to be COTS intensive. The Data Management Subsystem is expected to also require iteration of requirements and design. The Advertising Service of the Interoperability Subsystem will require DAAC/Science community iterative interaction. The Data Server Subsystem is expected to be COTS intensive and is needed in order to provide functionality to the Client, Data Management, and Advertising components.

4.1.3 Release Planning and Dependencies Considerations

There are now about 9 months in which to finish development of these Incremental Subsystems for Release B. Considerations of the components/objects that should/could be developed incrementally are: non-mission critical components, user interface framework components (i.e., web-related implementations), and distributed search components. In addition, consideration to reducing risks via constructive interaction with scientists and DAAC's (prototyping workshops), and risks of immaturity of object models and user models via iterative implementation, which allow the incremental developer to rework non-mature components before TRR. Taking advantage of the latest vendor products/class libraries is also another consideration when developing incrementally.

4.1.4 Prototyping

Prototyping plans are described in the SDPS Prototyping Plan White Paper. Of those described, only the ESDIS approved prototypes will be performed, and a subset of those will be released in an Evaluation Package (EP) - those that are user visible. In addition incremental developers may demonstrate prototypes prior to actual EP release in prototyping workshops. The following are the SDPS prototypes that are currently being recommended for EP incorporation:

- Client Scientist Workbench Service (data aquisition, on demand processing, web/java implementatin of the search and results functionality)

4.2   SDPS EP Strategy

As previously discussed, EPs are the delivery mechanism for incrementally developed components and selected prototypes requiring user interaction for sufficient evaluation. Table 4-1 shows the allocation of the capabilities from the SDPS subsystems described in Section 4.1 that have been selected for development via the incremental track and evaluation via an EP. For some prototypes, it is desirable to obtain feedback prior to its deployment in an EP. Table 4-1 depicts these evaluator feedback mechanisms as Prototyping Workshops (PW1, PW2, and PW3). The Prototyping Workshops host focused demonstrations and hands-on evaluation of components for which timely feedback is required before their incorporation into an EP or a release (in the case of PW3).

While it is true that incremental development is founded on the premise that iteration of design through exposure and procedural evaluation by eventual end-users will provide the feedback required for the refinement of those highly visible components, the subsystems delivered incrementally must interface with other components whose implementation cannot be adequately evaluated by an EP. For these subsystems, there exist specific engineering and technical challenges which are best mitigated by deliberate, focused prototypes or studies in order to provide the optimal solution. In addition, the degree to which an incremental component interfaces with or depends upon a component whose risk is managed through prototyping may be sufficient to require that prototyping be completed before the entire capability is submitted for evaluation to end users. The process through which such problems are identified and selected for prototyping is discussed in Section 3. Table 4-2 shows the SDPS Engineering Prototypes that have completed the prototype selection process and are documented in the SDPS Prototyping Plan White Paper. These prototypes will provide components to an EP, either directly through evaluation package delivery, or indirectly, by feeding into the design of an incremental component. The two tables have been aligned to illustrate the interaction between SDPS prototypes and the increments.

The EPs will provide increasing capabilities for end user evaluation, and will be a combination of components developed incrementally and selected prototypes. The following subsections will summarize the contents of the EPs in Table 4-1, and describes in more detail the incremental and prototyped portions of each delivery.

Table 4-1. Allocation of Prototypes and Increments to EPs

EP6 TRR 10/95	PW2 1/96	EP7 TRR 6/96	PW3 10/96	Rel B TRR 12/96
INC 1 **Client** User Profile and Application Defaults Advertising Service Inventory Search User Registration Help Menu **Data Management** Data Dictionary **Interoperability** Integration with Infrastructure API Advertising Service **Prototypes** **Data Management** Data Server I/Fs (Data Server component of Infrastructure) **Data Server** Data Type Services Browse, Acquire, Search Inventory Directory	**Prototypes** **Client** ESST Upgrade (fast results rendering) Desktop Upgrade Java Earth Science Tool UMCP Dynamic Query V0 WWW IMS **Data Management** LIM ECS/V0 Gateway Data Dictionary	**INC 2** **Client** ESST Enhancement Product Request Upgrade Document Search Tool User Regristraction Update Data Dictionary Tool Update **Data Management** LIM ECS/V0 Gateway Data Dictionary **Prototypes** **Client** Java Earth Science Tool DAR UI	**Prototypes** Client Web w/Java Search Tool ESST w/phenomenology searching Product Request Upgrade Document Search Tool Upgrade (free text search) DAR DPR **Data Management** DIM **Data Server** Subsetting (external)	**Formal** **Client** Remaining Client functionality **Data Management** Remaining DM functionality

Table 4-2. Release B Prototypes and Studies Relevant to the Incremental Track

Title	ECS Sub-System	Category	Status	Date Start/End
ASTER	S-CSS	TBS	TBS	*TBS*
Client Database Support	CLS	Technology	Completed	
DAR Prototype	S-CLS	Engineering	In-Progress	Sept 95 / Feb 96
DAR Prototype Follow-on	S-CLS			March 96 / June 96
DCE Secured Web Prototype	C-CSS	Technology	Completed	
Data Management Schema Maintenance	S-DMS	Engineering	In-Progress	Jul 95 /Mar 96
Data Processing Request	CLS	Engineering	In-Progress	Dec 95 / May 96
Earth Science Lan. and Protocols Study	N/A	Technology	Completed	
Earth Science Languages and Protocols Prototype	TBD	TBD	Proposed	*Feb-May 96*
Local Information Manager	DMS	Engineering	Completed	
LIM/DIM COTS	S-DMS	Technology	In-Progress	*March -May 96 2.5 (months)*
JAVA Client	C-CLS	Technology	In-Progress	Mar /May 96

4.3 SDPS Content for EP7

EP7 will include production code for several items presented in PW2 (i.e., ESST and LIM). EP7 will provide services from increments and prototypes in the following subsystems:

- EP7, SDPS Increment 2, Client Subsystem
- EP7, SDPS Increment 2, Data Management Subsystem
- EP7, SDPS Prototypes, Client Subsystem

The major capabilities delivered as Increment 2 in EP7 will be: 1) Guide Search , 2) Functionally enhanced ESST (Part of the Client Subsystem), 3) Incremental LIM (part of the Data Management Subsystem) and 4) fully functional ECS to V0 Gateway (also part of DM).

4.3.1 EP7, SDPS Increment 2, Client Subsystem

The Client Subsystem increments are categorized by X/Motif and Web components.

4.3.1.1 X/Motif Client (ESST Only)

Guide Search Link (ESST)

The ESST will issue a Guide Search by selecting the 'Guide' search type on the Search Screen. The Guide Search will be sent to the Document Search Tool (DST) and the (HTML) result delivered to the Client and displayed via the Client's WWW browser.

Data Dictionary Interface

Additional metadata will be acquired for initialization of the ESST from the Data Dictionary. This includes: attribute source (V0 or V1), collection/granule level attribute indicator, valid value processed attribute, and default search attribute flag.

Asynchronous Search & DSI Upgrades

The algorithm for determining the Single Point of Contact (SPOC) from the Client using the collection/data server mapping from the data dictionary will be implemented. Further, the asynchronous search will be tested with multiple connections to the LIM and Data Server. DSI upgrades include handling error conditions that occur (and returning that status message to the ESST) as well as updating the search message to accommodate sending polygonal spatial search criteria.

Timeline and Map Replacement

The EP6 Langley-based timeline and map will be replaced. The timeline will be replaced with one developed using Hughes' DELPHI package. The map will be replaced with one using the STK/PL library.

Reaggregation

Results set metadata can be regrouped in the aggregation widget using whatever attributes are desired.

Advertising Service Interface

The Advertising Service passes context information to the ESST upon selection of an acquisition for a given data advertisement. The context information is currently being ignored by the ESST. The ESST should not ignore this data, but instead use it to populate the ESST search screen.

One Results Window

Each independent search that is run previously resulted in independent results windows being displayed. This will change such that only one results window is displayed at a time, but the user may switch the display between different results sets at any time.

Save/Load Search and Results

This will enable the user to save and load his/her searches and results sets to local files.

Searchable region attribute

A new attribute will be added to the search screen called 'Region'. It will let the user select from a variety of geographic regions as part of his/her query. The attribute will participate in the valid value process. This provides a shortcut for selecting spatial regions.

Special valid value dialog pulldown

For attributes with numerous valid values, a dialog will appear with a built in find capability as well as scrolling capability to permit the user to select the value(s) of interest.

Phase II Data Server & LIM Interface

The DSI must connect to the new Phase II Data Server and upgraded LIM.

Product Specific Attributes

Support will be added for performing "Dependent attribute" greying out for those product specific attributes not valid given the selection of other attributes.

4.3.1.2 Web Client

Due to explosive acceptance of information publishing and accessing using World Wide Web (WWW or the Web) by the Internet community, a portion of the CLS functions are being developed using Web based technologies. The biggest advantage in shifting from X/Motif to Web paradigm is that Web based tools can be accessed from any Web browsers even from a PC or a Mac whereas X/Motif based applications run on Unix platform only.

Java, newest Internet technology, along with Web paradigm provide a perfect solution for a large scale distributed system like ECS. With Java we can bring hypermedia and interactivity into static Web pages, lets users interact with a web page. Java applets, compiled into bytecodes and downloaded to the Web browser when needed, are platform independent. This feature will significantly save the overall software life-cycle cost, e.g., no porting to/testing on multiple platforms, no deployment/installation of software to user workstation.

Although Java is a very promising technology, due to its stability and lack of tools ECS will only use it for prototype development at this time; the Java prototype seen in PW2 will continue in EP7.

The following tools have been identified as suitable candidates to be implemented incrementally using classic Web paradigm, i.e., a set of HTML3 pages along with corresponding server-end code (CGIs).

- **Comment Survey Tool (CST) -** allows users to give feedback concerning ECS services.

  The Comment Survey Tool offers a means for ECS user to give feedback to developers in an effort to build a better product. For each ECS application, there is a set of questions concerning the overall performance of the particular application with which the user may enter a scale of 1 to 5 to indicate his/her satisfaction. There is also a free text area provided for users to enter their own comments.

- **Data Dictionary Tool (DDT) -** provides a user interface to holdings in the Data Dictionary service.

  The Data Dictionary Tool provides access to the ECS Data Dictionary server which contains an acronym list and a glossary of terms, as well as definitions and descriptions of ECS metadata. Users can search the Data Dictionary database using free text expressions or navigate the index of terms. Aliasing of terms will be supported. The search result also shows interdependencies between terms. For example, the Data Collection result has links to the Instrument and Satellite descriptions as applicable.

- **Document Search Tool (DST) -** provides the ability to search for and browse through ECS documents, including research articles and Guide documents.

  The Document Search Tool allows users to enter keywords to search for a detailed [document] description of a number of data collections and related entities. A Guide search will initiate a search via LIM that eventually executes at one or more Document Data Servers. The results are displayed in the Web browser and the Guide documents can be navigated according to the hyper links available.

- **User Registration/Profile Tool (URT) -** allows a non-ECS user to request an ECS account and allows updates to an individual's profile after he/she becomes a registered user.

  The User Registration Tool will be the entry point for a non-ECS user to request an ECS account. An ECS registration form will be provided to obtain user information which includes name, organization, and all the essential data required by the MSS. The registration information will be forwarded to MSS for verification and processing.

The User Profile Tool facilitates modification of user information. This information will be stored in the User Profile database maintained by MSS and will be used by all ECS applications.

4.3.2 EP7, SDPS Prototypes, Data Management Subsystem

4.3.2.1 Data Dictionary Service

Since the EP6 implementation of the Data Dictionary Service (DDICT), the Release B design of the client - server interface has evolved. The EP7 DDICT will be upgraded to support the client - server interface that will be available at Release B. In EP7, the queries will still be specified as a GlParameterList specifying the "where" clause of a query. Future modifications (beyond EP7) will support Earth Science Query Language support.

The DDICT database will be upgraded to support the specification of synonyms or aliases. The client Data Dictionary Tool will use this information to present to the user terms that have the same or very similar meanings. This can be used by the user to broaden his/her knowledge of the meanings of terms. The aliases will be available on geophysical parameters only. For example, precipitation might be a synonym for rain.

4.3.2.2 Local Information Manager

The Local Information Manager (LIM) in EP7, will resolve the following types of requests to both V0 and the Data Server Subsystem:

- Search Requests - including document and database searches.
- Acquire Requests - submits request to get data electronically or on media.
- Browse Requests - supported for retrieving browse data and supplying it to the client.

For each request, the LIM will determine from the DDICT database which component(s) can satisfy the request, Data Server or V0 Gateway, and forward the request on. The document searches to the Data Server will be resolved by the Document Data Server. The document searches to V0 will be forwarded to the V0 gateway which will communicate to the V0 IMS Guide Servers.

All search requests that apply to both V0 and Data Server data will be integrated into one result set using a union operation. In other words, no relational joins will be performed in EP7.

4.3.2.3 Version 0 Gateway

The V0 Gateway in EP7 will be a fully functional ECS to V0 interoperability gateway. It is still not the full Release B gateway because it will not be bi-directional (i.e. integrated with the Release A Gateway) until after EP7. The V0 Gateway in EP7 will support the following V0 services from an ECS client to the V0 system.

- Inventory search
- Guide search

- Browse (integrated only)
- Product Request

4.3.3 EP7, SDPS Prototypes, Client Subsystem

Only one tool is being prototyped using Java and advanced Web technologies, e.g., Netscape's HTML extensions and HTTP cookies.

- **Java Earth Science Tool (JEST) -** provides an ESST like interface with reduced functionality to what a Java enabled Web browser can support.

  The Java Earth Science Tool is a prototype of the ESST using Java language. Only the major features (search, result, browse, order) to support end-to-end scenario will be implemented. However, concepts from other alternatives, e.g., Dynamic Query from UMd will be integrated.

  Currently, JEST can be run only using the Netscape 2.0, but we strongly believe, in the near future, all the Web browsers will support Java.

4.4 SDPS Content for PW3

Evaluation of prototypes from the Prototype Workshop 3 will provide input into key functionality remaing for Release B. Potential prototypes for PW3 are:

- Client Subsystem: Java Earth Science Tool with secure web server and sessions capability; functional ASTER DAR prototype; On-Demand Product Request User Interface; Subsetting User Interface;

- Data Management Subsystem: DIM

- Data Server: Subsetting Prototype (possible use or leverage of the external prototyping efforts in this area)

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5. CSMS Deliveries by EP

5.1 CSMS Development Plan Overview

5.1.1 Introduction

The Communications and Systems Management Segment accomplishes the interconnection of users and service providers, transfer of information between ECS (and many EOSDIS) components, and system management of all ECS components. It supports and interacts with the Science Data Processing Segment (SDPS) and the Flight Operations Segment (FOS).

At its highest design level, CSMS consists of three parts:

- **Communications Subsystem (CSS)**

  CSS is a collection of services providing flexible interoperability and information transfer between clients and servers. CSS services correspond loosely to layers 5-7 of the Open Systems Interconnection Reference Model (OSI-RM).

- **Internetworking Subsystem (ISS)**

  ISS is a layered stack of communications services corresponding to layers 1-4 of the OSI-RM. CSS services reside over, and employ, ISS services.

- **System Management Subsystem (MSS)**

  MSS is a collection of applications which manage all ECS resources, including all SDPS, FOS, ISS, and CSS components. MSS directly uses CSS services.

Table 5-1. CSMS Subsystems

CSMS Subsystems	Subsystem Service Superclasses
Communications Subsystem (CSS)	Object Request Broker Services Object Services Common Facility Services
Internetworking Subsystem (ISS)	Data Link and Physical Services Network Services Transport Services
Systems Management Subsystem (MSS)	Common Management Services Management Application Services Managed Agent Services

5.1.2 Development Track Allocation

As of the Release A CDR, CSS is wholly allocated to the formal track. This is a change from the last iteration of this Strategic Plan. CSS infrastructure capabilities required to support the incremental track are currently in place. Additional prototyping will be done to ensure maturing technology is progressing at a pace for required CSS service delivery time frames. MSS and ISS are also formal track subsystems. MSS will, however, develop prototypes where needed to demonstrate the soundness of new development for critical CIs (i.e., Mode Management).

5.1.3 Release Planning/Schedule/Considerations

Table 5-2 provides a characterization of the CSMS Service Superclassess by Release for Interim Release-1, Release A and Release B for the two subsystems which had been, up to Release A, developed incrementally. This information provides a background for understanding the end point for the incremental build-up of services for Release B.

Table 5-2. Characterization of Service Superclasses by Release

Subsystem Superclass		Major Component	IR-1	A	B
C S S	**ORB**	Interoperability framework		RPC via OODCE interfaces	RPC via OODCE interfaces
	Object Services	Interoperability Services	DCE core services	OODCE core services and Asynchronous Message passing Services	OODCE core services and Asynchronous Message passing Services
	Common Facilities	ECS-Specific Comm. Services	Heritage applications	Custom APIs on top of Heritage Applications	Custom APIs on top of Heritage Applications
M S S	**Common Management Services**	Management Framework:	HP OpenView	HP OpenView	HP Open View w/Mode Management
	Management Application Services	Fault Performance Accountability Security Trouble Ticketing Physical CM Config'tion MGT Rest	Basic Fault, Performance	Enhanced functionality from IR-1 and the remaining components	Fault Correlation Billing and Accounting Heritage Applications
	Management Agent Services	Extensible Agents	Native Agents	Extensible Agents	Extensible Agents

5.1.4 Dependencies (e.g. COTS Selection)

In the CSS subsystem, the key COTS item is DCE which available from several vendors. (including a beta version of DCE for SGI). A planned DCE 1.1 release is being considered for use by EP7.

In the MSS subsystem, the management services of Data collection, DB and fault require a COTS package. Availability is TBD. Enterprise Management will be provided by HP's OpenView. Fault management product will be provided by both HP OpenView and Tivoli Management Enterprise

5.2 CSMS EP Strategy

The overall CSMS EP Strategy is shown in Table 5-3. The table lists the Increments and Prototypes by EP which have been or will be provided by CSMS. EP6 is the delivery vehicle for evaluation of CSMS Increment 2, and provides code for Release A and EP7.

5.3 CSMS Content for EP7

EP7 will provide CSMS services from increments and prototypes in the following subsystems:

* EP7, CSMS Prototypes, MSS Subsystem

For EP7, the Management Subsystem (MSS), in addition to supporting and enhancing the four major service areas that were presented in EP6 (Registration, Management Agent Services, Management Framework, and Trouble Ticketing), will demonstrate basic Mode Management capabilities.

5.3.1 EP7, CSMS Prototypes, MSS Subsystem

Mode Managment

Summarized, mode mangement is the monitoring and control of various system activities, whether they are functioning sequentially or simultaneously, to ensure that the execution of one activity does not interfere with and is completely independent of the execution of another. These activites include Operations, Testing, and Training. Basic mode management will be demonstrated through HP OpenView using a single ECS application to demonstrate mode sensitivity.

Table 5-3. CSMS Increments and Prototypes by EP

EP4 TRR 11/02/94	EP6 TRR10/26/95	REL A TRR 4/01/96	EP7 TRR 5/15/96	REL B TRR 12/96

INC 0
Kerberos
APIs for SDPS
Intercell
Network Mgmt
  Performance
Interoperability
Access Control Lists
 	
Prototypes
ORB
DCE Encapsulation
Non-ORB OO DCE
DFS
Mgmt Subsystem
Interoperability
Infrastructure I/Fs
  (Interoperability
  Trader [static]
  component of
  Advertising Service
  prototype)
	INC 1
	Directory/Naming
	  Extensions
	Asynchronous
	  Message Passing
	Security
	
	Prototypes
	User Registration
	Management Agent
	  Services
	Management
	  Framework
	Trouble Ticketing
		CSS Rel A Services
		  as defined by SDS
		  table 6.4.3-1
		
		MSS Rel A Services
		
		ISS Rel A Network
		  Services
			Prototypes
			Mode Management
				CSS Rel B Services
				  as defined by SDS
				
				MSS Rel B Services
				
				ISS Rel B Network
				  Services

6. Science Datasets and Science Support Scenarios

6.1   Introduction

EP science datasets are samples of science-related data to be used in developing, testing and demonstrating EP functionality. The sample datasets are used to populate portions of the EP Data Server to allow realistic assessment of client data-server interaction. Test data is obtained primarily from the DAACs, however, simulated metadata and data are also considered since they offer an inexpensive and efficient way to enhance the EP evaluation. Exploration of ECS metadata and browse data structures, however, will require some conversion of existing datasets from the their native formats into ECS formats. Candidate datasets are chosen based on the phasing of EP functionality as well as the expected cost to incorporate datasets into the EPs.

Another factor to be considered is the size of the data set. Incorporation of large datasets in the EPs could result in premature purchase of expensive storage. The EP Team working with ESDIS/SDPS representatives determine the phasing of EP functionality and, subsequently, identify and iterate on the candidate datasets.

After functionality and candidate datasets are established for the EPs, established science user scenarios are examined to determine the extent to which they can be realized within the EP functionality. In fact, functionality, datasets and scenarios are all iteratively refined as the incremental design matures, the cost of incorporating datasets becomes better understood, and scenarios are defined with lower level details.

6.2   Dataset Roles and Responsibilities

The ECS EP Team has the responsibility of identifying and requesting from the DAACs sample data and browse products (if available) appropriate for the planned EP functionality. Working together with the DAACs, the ECS EP Team and the DAACs will determine the best approach for transferring the data from the DAACs to the EP Team. Data transferred to ECS for use in EPs will be used for development and test only.   Conversion of metadata is the responsibility of the ECS EP Team.

6.3   Science Data Availability

Key reasons for obtaining test data and metadata for EP evaluation include: evaluation of EP prescribed functionality, scalability testing, and evaluation of potential user scenarios. In terms of science scenarios, there are several factors that drive their creation and acceptance, as well as place limits on feasibility. One factor is the the planned EP capabilities per EP. Another factor limiting the range of possible science user scenarios is the availability of suitably formatted data and associated metadata. The decisions with regard to data require iteration with the range of science scenarios that can be supported by the EP.

6.3.1 EP7 Data Needs

Data and metadata are needed for EP7 to support the provided services. These include:

Advertising Service: Dataset descriptions that include the EP7 inventory.

Data Dictionary: Definitions of terminology.

Search Services: A subset of the ECS Core Metadata for guide and inventory-level information.

Browse Service: Browse products for the inventory data.

EOSView: Sample data in HDF (and HDF-EOS) to demonstrate EOSView functionality.

Data Order: Sample data products for limited FTP access

6.3.2 V0 Data

The DAACs have a variety of readily accessible data which can potentially be used in developing, testing and demonstrating EP functionality. An effort to migrate selected V0 data into ECS formats is in the early stages, and a potential data source for EP7. The V0 data migration effort includes data reformatting, metadata reformatting, metadata generation, browse reformatting/generation, supporting documentation and additional material needed to use the data.

The coordination of data migration needs of EP7 with the larger V0 data migration efforts is desired to minimize expended efforts and to share the lessons learned. In view of the larger V0 data migration effort, some considerations in selecting V0 data to be acquired for EP7 include the effort needed to:

- Convert data format to HDF (and HDF-EOS).
- Generate a browse product.
- Establish the collection level and granule level metadata for EP7.
- Create Advertisements and Data Dictionary Entries.
- Establish guide information or references.

6.3.3 Candidate Data Sets

The candidate data sets for EP7 will come from a variety of sources. As discussed above, the V0 migration effort is definitely a prime candidate for some test data. In addition, the EP team expects to select test data products from all associated DAACs in order to increase variety and obtain parameter rich data and metadata. In addition to the DAACs, there are some ECS associated test data sets that offer a variance in terms of type of product as well as extended metadata, which are key elements for EP evaluation. Finally, metadata and data in the ECS specific format are being generated as simulation test data for the projected AM-1 and PM-1 programs. This simulated data will produce approximately 90% of the expected program metadata projected through 2002, and will include some fostered data items. The simulated data will contribute greatly to the scalability testing as well as provide users more with a sense of the expected ECS data types.

For EP6, several key data sets were identified with the above criteria in mind. It is possible that these will also be used for EP7. These data sets and some relevant characteristics are listed in Table 6-1.

The 1km AVHRR data are available on-line from the EDC DAAC. While not in HDF, the necessary code to convert these data has already been written and tested as part of the V0 data migration effort. The associated metadata is already available, and was used in PW1. These data also support the science scenario described in Section 5.1.

The ERBE and ISCCP data are available on-line via the LaRC DAAC IMS. However, the ERBE SG4 and the ISCCP C2 data are the only data which are already in HDF. The V0 metadata for these data are adequate for EP7, requiring no additional effort to collect. These data also support the science scenario described in Section 5.2.

Table 6-1. EP6 Dataset Characteristics: Possible Reuse for EP7

Data Set	Spatial Coverage	Temporal Coverage	No. of Granules/ Size (MB)	Browse (MB)	Format	Source of Data	Source of Metadata
AVHRR, 1 km, 10-day composite NDVI	North America (L3)	Apr92 - Mar93	36/135 [1]	TBD[2]	Raster Image [3]	EDC	PW1
ERBE SG4	Global (L3)	Jan85 - Dec90	64/ 12.8	0.8 [4]	HDF	LaRC	V0
ISCCP_C2	Global (L3)	Jan85 - Dec90	60/ 4.4	None	HDF	LaRC	V0

Notes: 1 - Can be compressed by a factor of 10:1

2 - If not available, a browse product will be created by subsampling product granules.

3 - Code already written to convert to HDF. This has been done as part of the V0 pilot migration effort.

4 - Some granules have browse products

In addition to the EP6 Data Sets describe above, ECS has been collecting and using key data and metadata for evaluation in Prototype Workshops and EPs since PW1 (see Table 6-2). These data and metadata items were brought in to help fulfill the need to evaluate ECS prototypes with added depth and breadth. The data sets vary in terms of how much metadata and actual data items supported, but all provide the commonality of the ECS Common Core Metadata (CCM) model.

For EP7, the EP team is planning to continue to build upon this metadata and data foundation, while beginning to demonstrate system support beyond the CCM model and allowing for a greater variety of data items.

Table 6-2 Current ECS Test Data Holdings

Package	Data Sets Introduced
PW1	AVHRR 09ANGB 1D AVHRR 09ANGL 1Y CAC SST EDC Global 1 km Data Set Halpern Atlas MCSST CDROM Miami MCSST Miami MCSST Nightime
EP6	EDC Global 1 km Data Set- North America, 1 km AVHRR 10-day composite NDVI ERBE S-4G scanner 2.5 degree regional averages ISCCP_C2
PW2	TOVS Pathfinder C1 MSU Daily AM (CH 2/3, CH 4, Ocean Precip) SSM/I Wentz Geophysical Products from DMSP-F10 TOVS Pathfinder C1 MSU Monthly AM (CH 2/3, CH 4, Ocean Precip) TOVS Pathfinder C1 MSU Pentad AM (CH 2/3, CH 4, Ocean Precip) MSU Daily Precipitation with LIM93 correction Wallis, Lettenmaier and Wood Hydroclimatology Jaeger Monthly Mean Global Precipitation SSM/I Wentz Antenna Temperature from DMSP F8

6.4   Science User Scenarios

Through prior work with the scientific community, the ECS User Modeling efforts, identified and elaborated 27 user scenarios, representing the manner in which both the system and the data will be accessed. An analysis of these scenarios can be found in *User Scenario Functional Analysis* (194-00548TPW). The advantages of building on this baseline of science user scenarios include:

- Maximizing the return from previous efforts

- Employing a stable reference for assessing incremental enhancements of EP and ECS capabilities

The goal for EP7, much like EP6, is to continue to review the existing set of approved science sceanrios, but to also create scenarios relevant to the test data captured. Two of these established user scenarios matched EP6 functionality well, and are listed below. EP7 will support these scenarios again and any additional ones based upon the total ECS test data holdings. These scenarios are prime examples of end-to-end user scenarios that incorporate sufficient richness to be useful for evaluating EP capabilities.

6.4.1 Scenario 1: Monitoring of Sugarland Run Watershed

In this scenario, number 6 of the 27, the investigator (Jerry Garegnani) wants to determine correlations between land use patterns and water quality of Sugarland Run, a Potomac river tributary. This involves building a database documenting changes within the watershed, including vegetation over the course of the growing season.

As written, the scenario involves MODIS, ASTER and Landsat-7 data, as well as a one-time order of DEM data. The main adjustment of this scenario, delineated in Table 6-3, is the use of 1 km AVHRR-derived NDVI for North America.

Steps involving browse of selected data have been added to the original scenario. Also added are steps involving an advertised tool for determining Precipitable Water Index (PWI). The variation in PWI has recently been shown to have an effect on NDVI values for the same vegetative condition comparable or larger than those of variable aerosols and surface emissivity.

6.4.2 Scenario 2: Obtaining Information/Data for a Review Paper

In this scenario, number 13 of the 27, the investigator (Bruce Barkstrom) wants to prepare a review paper about the Earth Radiation Budget, including recent developments of the ECS instruments. As written, the scenario involves CERES data, as well as bibliographic references. The main adjustment of this scenario, delineated in Table 6-4, is the use of ERBE and ISCCP data.

Table 6-3. Preliminary Science Scenario: Monitoring Sugarland Run Watershed

	Step	Aspects Requiring Future Capability
1	Connect to EP7	
2	Start ESST, specifying search criteria	Additional types of data that the investigator would like to search are: o land cover classes o land surface reflectance values
3	Examine the search results	
4	Select products for browse and initiate transfer: (AVHRR 1 km, North America 10-day composite NDVI) (This step has been added to the original scenario.)	
5	Visualize browse data with EOSView. (This step has been added to the original scenario.)	
6	Select products for order: (AVHRR 1 km, North America 10-day composite NDVI for April - September 1992)	Investigator would like to have the data sets subsetted and sent via ftp.
7	Submit and confirm order.	
8	Intiate guide search using search parameters defined in ESST. (Using URL for appropriate EDC WWW page in place of the Document Data Server)	
9	Exercise data dictionary service to clarify usage of term (e.g., NDVI)	
10	-	Establish a standing order for the selected data to be subsetted and sent via ftp and CD-ROM
11	Discover advertisement for tool to compute Precipitable Water Index (PWI). Variation in PWI will influence NDVI values computed for the same vegetative condition. (This step has been added to the original scenario.)	
12	Download PWI tool from referenced ftp site, and installs on Desktop (This step has been added to the original scenario.)	
13	Modify search criteria to determine availability of related data for computing PWI: (AVHRR channels 4 and 5)	Investigator would like to check on availability of: snow cover data, digital elevation data, soil type data
14	Request additional guide information on AVHRR Channels 4 and 5.	
15	Select products for order: (AVHRR 1 km, North America 10-day composite channels 4 and 5, April - September 1992)	
16	-	Establish another standing order for selected data to be subsetted and sent via ftp and CD-ROM.
17	Log out from EP6	

Table 6-4. Preliminary Science Scenario: Information/Data for Review Papaer

	Step	Aspects Requiring Future Capability
1	Starts Client and connects to EP6	
2	Start ESST, specifying search criteria: o LW, SW radiative fluxes, albedo o July 1989	
3	Examine the search results	
4	Select products for browse and initiate transfer. (ERBE_SG4, ISCCP_C2)	
5	Visualize browse data with EOSView.	
6	-	Investigator would like to obtain only the SG4 values for the cloudy regions, since he desires only the cloud forcing values.
7	Select products for order via ftp. (ERBE SG4 and ISCCP C2)	
8	Submit and confirm order.	
9	Locate guide information for algorithms via advertising service, and examine. (Using URL for appropriate EOS Science Office WWW page for ERBE ATBDs in place of the Document Data Server)	
10	Exercise data dictionary service to clarify usage of term	
11	Copy the desired algorithm description via ftp.	
12		Investigator wants to search for and inspect relevant reference papers in the Document Data Server
13	Modify search criteria to determine availability of related data: (Net Surface Radiation, January 1989-July 1990)	
14	Select products for order via ftp. (ERBE SG4)	
15	Submit and confirm order.	
16	-	Modify search criteria to determine availability of Synoptic data, containing instantaneous field characteristics. These correlations are examined using a regression analysis.
17	Log out from EP6	

6.5   Future Data Needs

An additional consideration in selecting data for use with EP7 is the possibility for supporting evaluations/demonstrations of future prototype workshops, EPs (Release C) and client capabilities (e.g., subsetting and other data services). The potential for using the data for system integration and test of ECS should also be a consideration for selection.

One consequence of these considerations is that the full data resolution should be acquired rather than requesting that the DAAC perform subsetting or subsampling. If storage of the full data is not possible with the EP Science data server, then strategies of limiting the number of available granules should be employed.

Also, in an effort to preserve what ECS has already captured, a permanent data archive testbed is now being created to host all previous (Table 6-2) and future data holdings. This archive will not only serve EPs and PWs, but will also be used to evaluate prototypes being reviewed by the ECS Technology Transfer Testbed (ET3).

7. Intersegment EP Interfaces

Interfaces between CSMS and SDPS for EP7 are listed in Table 7-1. The table is organized by CSMS Subsystem, Service Superclass and Service Class. The majority of the interfaces are with the CSS subsystem. Table 7-1 is built using Table 6.3.4-1 in the System Design Specification (194-207-SE1-001). Table 7-1 lists only those CSMS service classes which will be available for Release A (EP7 will use no Release B CSMS services). The CSMS EP Plan column describes in what fashion each service class will be developed. The SDPS interface column lists how SDPS will make use of the CSMS provided service classes.

Descriptions of the service classes are available in the System Design Specification.

Table 7-1. Intersegment EP Interfaces by CSMS Subsystem

CSMS Sub-System	Service Superclass	Service Class	CSMS EP Plan	SDPS Interface
CSS	DOF	IDL	OODCE IDL++	All applications for defining distributed objects
CSS	Object Services	EventLog	DCE API	All applications for logging events
CSS	Object Services	Naming	Directory service + encapsulation of XDS/XOM interfaces for the Directory and Naming service	All client applications to bind to server objects
CSS	Object Services	Security	Encapsulation of OODCE Security	All distributed objects
CSS	Object Services	Threads	OODCE Threads	All server applications within CSS Asynchronous message passing service
CSS	Object Services	Time	DCE Distributed Time Service	not applicable
CSS	Object Services	Asynchronous Message Passing	A custom layer on top of OODCE	Acquire Notifications from Data Server
ISS	(multiple services)	(multiple services)	As required to support EPs	Data Transport and OS Access
MSS	Common Mngmnt	Trouble Ticketing	HTML and Remedy	HTML is used by end user Remedy is used by M&O
MSS	Mngmnt App	User Account Management	HTML and custom implementation on OODCE	Used by M&O
MSS	Extensible Agents	Management Agent	Custom implementation on OODCE	not applicable (MSS internal use only)
MSS	Common Mngmnt	Management Framework	HP OpenView w/Mode Management	used by M&O

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8. EP Integration and Test

8.1　EP I&T Process Overview

The EP Integration and Test (I&T) process focuses on proper functional integration as well as fault elimination from each EP release. I&T is performed on EP software before it is deployed outside of ECS contractor control to assure an appropriate level of stand-alone robustness. (Note that Prototype Workshops do not require the I&T described in this section because they are not deployed.) Various test and validation techniques are implemented to provide an effective process in finding and eliminating faults. Typically, the faults associated with an EP release can be categorized as follows:

    a) Functional - in terms of the available user tasks and products;

    b) Interfaces - between applications, networks, DCE, protocols;

    c) Performance - utilization of resources over the distributed network.

The development and integration of EP components is part of the incremental and protrotyping ECS tracks. As such, the iterative development cycle requires a decrease in the documentation. In spite of this, the tailored EP I&T process as described herein will provide effective validation for each EP release. In addition, the ECS Quality Assurance (QA) and Configuration Management (CM) groups will assist the EP I&T team in the following areas:

- QA
  - Assistance in reviews and inspections (code, test notebook, test reports, etc.);
  - Collection of process metrics;
  - Assistance in NCR tracking;
  - Test witnessing (when appropriate);
- CM
  - Configuration Management control.
  - Build software for test execution and deployment.

The EP I&T team integrates separate incremental components and selected prototypes into an end-to-end system able to perform Evaluation Package functions. Initially, the Development organization performs early integration of low level components with the I&T organization's support and coordination. The integration and testing is performed based on the build/thread plan documented in Section 8.3. The EP I&T organization works with the Development organization to complete testing based on the EP I&T Procedures (Section 8.4). The Development organization is responsible for assisting in problem diagnosis and for correcting software problems. The EP I&T organization is responsible for running the tests, documenting problems detected, verifying fixes, and writing the EP I&T Report at the completion of the tests. The results of the Integration and Test stage are documented in a series of folders (see Table 8-1). Figure 8-1 depicts the EP I&T process .

Table 8-1. Integration and Test Documentation

Folder Name	Folder Description
EP I&T Notebook	Documents the EP I&T environment, the Build/Thread diagram, and the test cases along with their respective procedures. Responsible organization: Development
EP I&T Report	A report is developed for each EP to identify results of the increment testing. Capabilities successfully tested and capabilities failing testing (and a justification for removing the failed capability from the increment) will be documented. Responsible organization: EP Integration and Test
Development Notebooks	Supporting material describing problem fixes are documented in the existing Development Notebook folders. Responsible organization: Development
Non-Conformance Reports (NCRs)	Problems identified during integration and test are documented in a problem report data base as Non-Conformance Reports (NCRs). The status of NCRs (e.g. open, assigned, closed) and other information are stored and provided to EP reviewers at status reviews. Responsible organization: Integration and Test.

The EP I&T team's responsibilities include developing the EP I&T Notebook, support of the EP integration activities, execution of independent EP functional testing, and deployment of the EP (to include regression testing) to the operational environment and to all the evaluators client machines. Upon completion of the increment integration and test activities, an EP Readiness Review is held initially with program management. The EP I&T Report is reviewed and open problems (associated with failed test cases) are evaluated. EP management and developers must concur that capabilities left out of the EP are acceptable before the EP integration and test stage is considered complete.

8.2   EP I&T Organization

During each EP development cycle, an inter-segment team is formed that includes members from the various ECS development and test organizations (Figure 8-2). The EP I&T team may contain members of the Release B I&T organizations as well as the IATO organizations. Table 8-2 describes the roles each of these team players have in the EP I&T effort. The tailored EP I&T process consists of a subset of test and integration phases from the formal track. In general, EP I&T efforts will address the areas listed in Table 8-2. More specifically, the segment developers will be responsible for the unit level tests, while the EP I&T team will focus on system level functional and interface tests as well as performance evaluations on those components that have been integrated.

Table 8-2. EP I&T Roles

Players	Test Type				
	Component Integration & Unit Tests	Functional Tests (Threads)	Integration Tests (Builds)	System & Performance Evaluation	Usability Testing (Scenarios)
Segment Developers	Responsible				
EP I&T	Assist	Responsible	Responsible	Responsible	Assist
EP Evaluation Leader					Responsible

8.3   EP Build/Thread Plan

The build/thread concept, which is based on the incremental aggregation of functions, is used to plan the EP I&T effort. A thread is the set of components (software, hardware, and data) and operational procedures that implement a function or set of functions. Threads are tested individually to facilitate requirements verification and to isolate problems. A build is an assemblage of threads to produce a gradual buildup of system capabilities. Builds are combined with other builds and threads to produce higher-level builds. Verification of threads and builds is accomplished at progressively higher and higher levels as the EP is assembled.

The build/thread process allows I&T to occur in parallel with EP development. As components are developed and pass unit tests, they are integrated into threads and subsequent builds. Regression testing of previously integrated components occurs at each build integration to verify the evolving EP components operate as a cohesive product.

The Build/Thread plan for an EP is developed as part of the EP/Increment I&T Plan. Typically, EP builds and threads account for a subset of the overall functionality as provided in the ECS Builds and Threads described in the System Integration and Test Plan for the ECS Project (194-402-VE1-001).
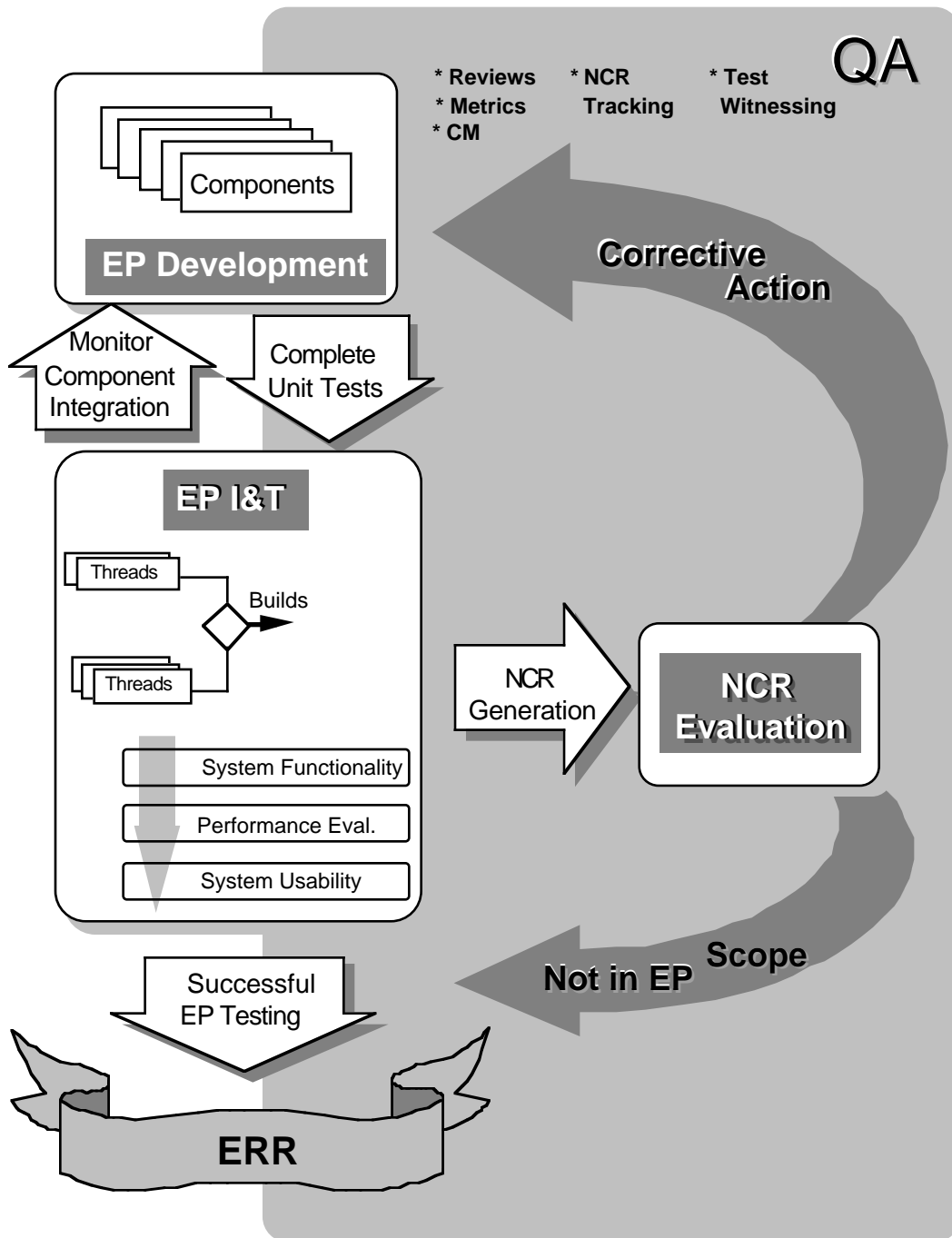
Figure 8-1. EP Integration and Test Process

Test Steering Committee	EP Test Team
- Rel. A I&T Mgr - Rel. B I&T Mgr - IATO Mgr	- I&T Lead - Staff From I&T Orgs
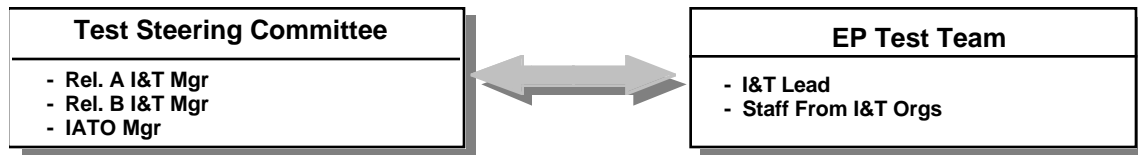
Figure 8-2. EP I&T Team Organization

8.4   EP I&T Notebook

The EP I&T Notebook will provide the following information:

- I&T hardware and software configuration

- Build/Thread diagram plan

- Test Overview - breakdown of the actual tests to be performed (typically a functional breakdown)

- For each test outlined in the overview the document will provide:
    - Test Objectives
    - Test Resources
    - Dependencies (if any)
    - Test Cases
    - Test Procedures for each Test Case

The actual detailed test case procedures will be provided as part of the EP I&T Test Report. A subset of the procedures will be selected to also be developed and maintained using the ECS Capture/Playback Test Tool XRunner.

Test cases will be written to exercise both custom code and COTS packages. Through the use of the ECS Capture/Playback Test Tool, single-user emulation tests will validate specific functionality while multi-user emulation will provide accurate and repeatable system load and performance tests. The ECS Capture/Playback Test Tool used is XRunner by Mercury Interactive Corporation.

A number of tools will be part of the EP I&T process:

(i)   ClearCase Configuration Management;

(ii)   Requirements Traceability Management (RTM);

(iii)   DDTS for NCR tracking;

(iv)   Single and multi-user Capture/Playback Simulator for functional and system level tests;

(v)　　　　CS custome code drivers

(vi)　　　　Instrumented applications (e.g., APIs) as well as ECS custom and COTS log files (e.g.,　history logs);

(vii)　　　　CDS Browser to monitor and administer DCE based applications

8.5.　EP Test Non-Conformance Tracking

Once developed components are integrated, the EP I&T team will conduct tests defined in the Build/Thread plan that address the EP functional objectives. The EP I&T process will then provide feedback to the developers through the recording and tracking of discrepancies - Non Conformance Reports (NCRs) - during testing. Since the EPs are focused on particular functionality, an assessment of each NCR is made to determine whether it will be corrected within the current EP release. The impact of the error on the EP objectives is the prime consideration in this assessment. In addition, a distinction will be made between NCRs recorded against increments versus those recorded against prototypes. The EP Test report will document any known discrepancies in the delivered product.

Table 8-3. Sample NCR Tracking Form

NCR ID #:	Status:
Test Priority:	❍ Open　　❍ Closed　　❍ Fixed
Test Case Name:	❍ Duplicate　　❍ Withdrawn
Submitted By:	
Entry Date:	Priority:　❍ 1　　❍ 2　　❍ 3
Problem Title:	
Problem Description:　　❍ Increment　　❍ Prototype	

Table 8-4. Non-Conformance Report (NCR) Procedure

(T0 Time of problem)	**PROBLEM DETECTED** • Enter the NCR (Developer or I&T) • The NCR tool will notify the developer of the problem, when it is submitted, by electronic mail.
(T1 Next Morning)	**NCR REVIEW (Daily)** • An updated NCR list will be distributed containing all new and updated NCRs from the previous morning. • Originator will describe new NCRs. • Code engineer assesses validity of problem. • Determine Corrective Action if known and estimate of the time to fix. • Group assigns priority. • After meeting, QA updates status of NCRs (priority, risk, status, etc.).
(T2 T0 + 1-3 days)	**BUILD** • Developer Makes Fix • Developer Indicates Action Taken to correct fixed NCR on form. • The NCR tool will notify I&T when the developer updates the NCR status to fixed. • CM will re-build software with direction from I&T. • All Fixed NCRs documented with corrective action.
(T3 T0 + 4 days)	**RETEST** • I&T Retest for Problems • Regression Test of Affected Components • Results discussed at the next NCR Review.

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9. EP Resources

9.1 EP Resources Overview

An overview of EP Resources is shown in Figure 9-1. These resources were used to deploy EP3. No major additional resources are required for EP4

ASF (Fairbanks, Alaska)

DCE Client
HP
trouble.asf.alaska.edu
137.229.37.51

Cell Name: epcell

EDF (Landover, MD)

DCE Client
HP
edrob.gsfc.nasa.gov
192.150.28.18

DCE Client
HP
epserver.gsfc.nasa.gov
192.150.28.17

EDC (Sioux Falls S.D)

DCE Client
HP
ecs-hp1.cr.usgs.gov
152.61.192.99

DCE Client
SGI
ecs-alpha1.cr.usgs.gov
152.61.192.100

1.5 Mbps

GSFC (Greenbelt, MD)

DCE Client
HP
ecs.larc.nasa.gov
192.107.191.24

NSIDC (Boulder, CO)

DCE Client
HP
snowfall.colorado.edu
128.138.135.40

LaRC (Norfolk, VA)

DCE Client
HP
ecs.larc.nasa.gov
192.107.191.24

JPL (Los Angeles, CA)

DCE Client
HP
wave.jpl.nasa.gov
137.79.108.188

DCE Client
SUN
searider.jpl.nasa.gov
137.229.37.51

MSFC (Huntsville, AL)

DCE Client
HP
hydra.msfc.nasa.gov
128.158.25.18

Figure 9-1. EP Resources Overview

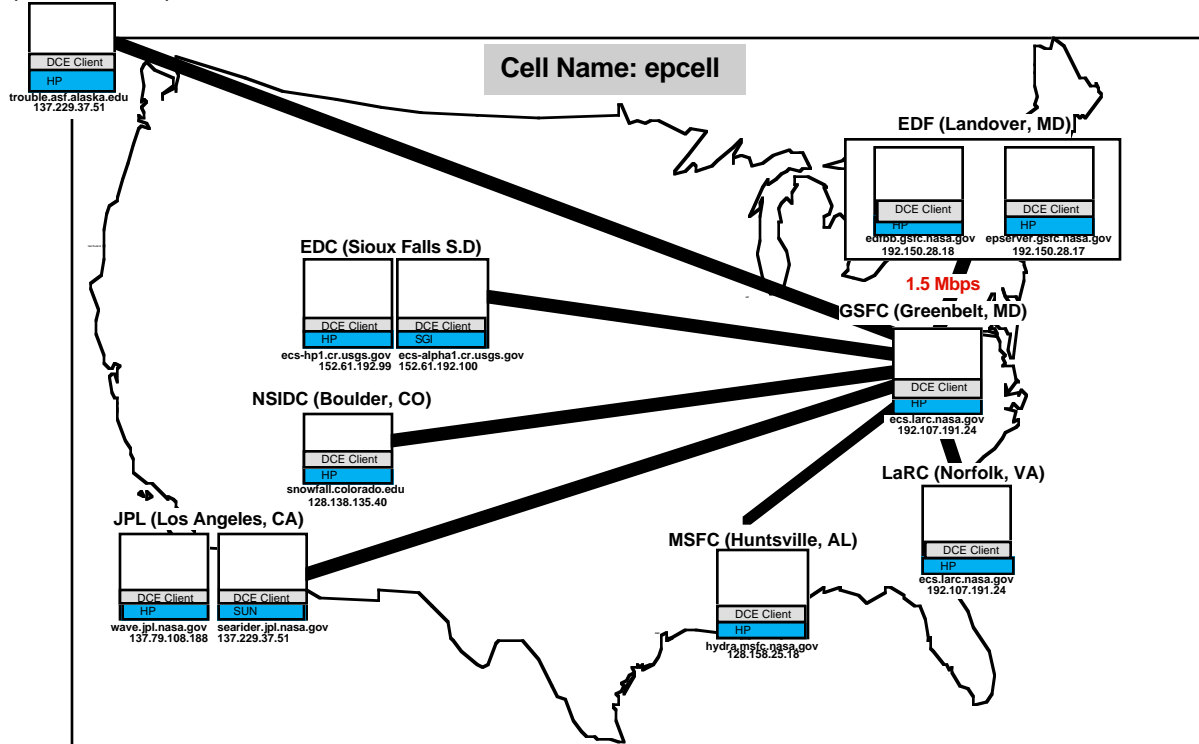## 9.2 EP Workstations

The main resources for EPs are workstations at the EDF and the DAACs (Table 9-1). The configuration of these workstations is governed by ECS Development Facility (EDF) Policies and Instructions (ECS PI SE-1-002). These workstations are also used by the ECS DAAC Liaisons for additional purposes.

Table 9-1. EP Workstations

Node	IP Address	Model	OS Version	Location
ecs	192.107.191.24	HP 715/50	HP UX 9.0.5	LaRC
ecs-hp1	152.61.192.99	HP 715/50	HP UX 9.0.5	EDC
ecsgsfc1	128.183.118.44	HP 715/50	HP UX 9.0.5	GSFC
edfbb	192.150.28.18	HP 715/50	HP UX 9.0.5	EDF
epserver	192.150.28.17	HP 735	HP UX 9.0.5	EDF
hydra	197.107.196.75	HP 715/50	HP UX 9.05	MSFC
searider	137.79.32.82	Sun Sparc10/40	Solaris 2.4	JPL
snowfall	128.138.135.40	HP 715/50	HP UX 9.05	NSIDC
trouble	137.229.37.51	HP 715/50	HP UX 9.05	ASF
wave	137.79.108.188	HP 715/50	HP UX 9.05	JPL
ecs-alpha1	152.61.192.100	SGI	IRIX 5.3	EDC

9.3   Networks for EPs

Data communications needs fall into two categories:

- Users will access the Evaluation Package via the V0 network and/or the NASA Science Internet (NSI), a TCP/IP-based network within the Internet. Some users may need to be granted access to NSI.

- A dedicated V0 link connects the EDF and the GSFC campus network, for EP access to the V0 network and the NSI. The link includes the transmission medium itself, terminating multiplexers on both ends, and an interface unit (e.g., bridge or bridge-router) at GSFC.

9.4   Science Data

Science data to be used in EP evaluations are described in section 6. These data are located on the EP Data Server at the EDF.

9.5   Coordination of EP and Formal Release COTS Procurement

COTS Software beyond that procured for EP7 has already been purchased. The software to be used in EP7 is listed in Table 9-2.

Table 9-2. EP7 Software

	Version
DCE	1.0.3
OODCE	on DCE 1.0.3
C Native compiler	Sun 3.x, HP 9.077, SGI 3.19
C++ Native compiler	Sun 4.x, HP 3.65, SGI 4.0
Sybase	11
Rogue Wave C++ tools	6.1
Rogue Wave DB tools	1.0
Clearcase	2.x
HTML Server	NCSA Httpd 1.4.2

For future EPs, procurement will be consider in light of COTS procurement for the Formal Releases. COTS Procurement for Formal releases follows dates as recorded in the ECS Level 1 Master Schedule. A summary of those dates in recorded in Table 9-2.

Table 9-3. Formal Track COTS Procurement Dates

	IR-1	Release A	Release B
COTS Requirements Defined	11/94	7/95	4/96
Final PO Release	5/95	9/95	9/96
Final HW/SW Delivery	8/95	11/95	12/96
COTS HW/SW Installation	11/95-12/95	11/95 - 2/96	1/96 - 5/96

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10. Evaluation Process

10.1 EP Evaluation Approach

Evaluation Packages are used to make selected functionality available for evaluation and to assist in the refinement of the implementation of that functionality. EPs will be evaluated on their ease of use and user satisfaction, by means of Usability Testing and an on-line user survey called the Comment Survey Tool (CST). The usability tests are conducted in a controlled environment that allows for observed and measured response during evaluation of design efficiency. The Comment Survey Tool is an on-line survey tool that collects user preferences and suggestions. This survey is available to EP evaluators within the timerange of the defined Evaluation Period.

Several user groups will participate in EP evaluation: Science users, Operations and User Services personnel, and ECS Developers. These different groups were chosen because they may be accessing the EPs for different reasons, and will require different EP functionality to suit their needs. Each user group will be asked to test the various EP features and capabilities at different stages in EP development.

The Evaluation Process is diagrammed in figure 10.1, the portions of the diagram explained within this document are highlighted. Sections 10.2.1 Usability Testing and 10.2.2 Comment Survey Tool (CST) provide details about the methods employed during the EP Evaluation Period (shown in figure 10.1). The results and actions taken after the EP Evaluation Period are discussed in section 10.4 EP Results Integration.

10.2 Evaluation Methods

10.2.1 Usability Testing

The usability test will evaluate the efficiency of the user interface designs of EP components. These components include: EP user interface mockups both in X/Motif and HTML, data search tool, data browse and animation functions. Developers are involved in the usability test as observers to obtain first-hand reactions to their products. The data from the tests are compiled, analyzed and then presented to developers where they are used to improve the user interface in the designs of windows, layout of screens, buttons, selection parameters, window hierarchies, and help messages.

Pretest Preparation

Test Environment: The tests are conducted at the ECS Development Facility (EDF) in a controlled-environment that mimics the environment of a typical user. Test Participants (representative end-users) are selected from the available NASA evaluators (also known as "Tirekickers"), representatives users from the larger science community, DAAC users and User Services personnel. A Facilitator will coordinate the test and note the time for each test task. Members of the Development team will be invited to observe the usability test sessions. To ensure a standard test environment and to avoid hardware biases, all usability tests will be conducted on the same machine, under similar system load.
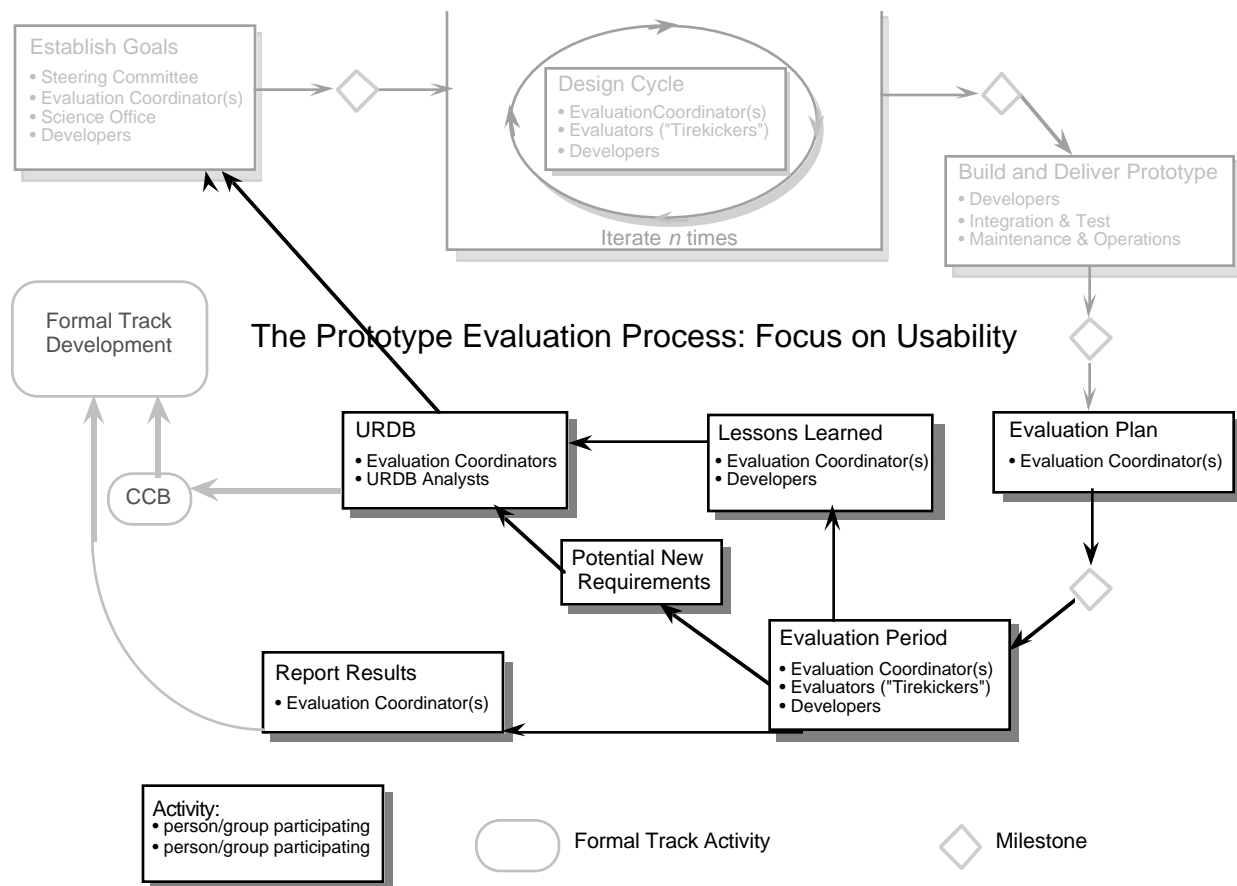
Figure 10-1. The Prototype Evaluation Process: Focus on Usability

Task Definition: A series of simple tasks will be defined such that, when these tasks are executed successively all the user interface capabilities of the EP are tested. The tasks are defined to allow the Participant to evaluate significant portions and capabilities of the EP.

Metric selection: For each task a number of metrics are measured; a)Time-to-Perform and b) user satisfaction rating (usability index). If resources allow, c) error rate and d) task retention are measured.

Test Participant Selection: Participants with a wide range of experience and various levels of exposure to the EP are selected. For example, the Science user group Participants will include scientists who are familiar with the concepts of the EP features being tested but will be using the EP for the first time, scientists with some familiarity with the EP, and Scientists who have used the EP several times. In addition, Operations and User Services personnel will be asked to test the EPs for usability. These groups will use the EPs in different ways and will require a system adapted for their needs. To determine a baseline, or "best time" score for completing each task to measure the effectiveness of the user interface, the EP developers will be participating in the usability testing.

Usability Testing Sessions

Participant briefing: Before the commencement of the test, the Participants are briefed about the goals of usability testing and the test procedures. It is emphasized to the Participant that the purpose of the test is to test the usability of the software and not the Participant, or their use of the software. The Test Participant is encouraged to comment aloud as they execute each task and after the completion of each task.

Usability test: The usability test will last about an hour. The Participants are given one task at a time, and the Facilitator will note the start- and end-times for each task. Any comments that are made by the Participant are noted by the Facilitator. The developers, who observe the test sessions, will watch for problems and opportunities for improvements and note them.

At the end of the test the Participants are requested to complete an Exit Survey that summarizes their experience testing the software and contains questions relating to each task and portion of the EP. The Exit Survey also asks Participants about their previous computer experiences and computing environments.

Data Compilation and Reporting

The synthesized metrics, the results of the Exit Survey, the analyses, the user comments, the potential usability trouble areas, and the recommended changes are compiled in a report. A report will be published after each formal EP review. After the workshops a less formal compilation of results and any statistics collected will be made available.

Usability Testing (UT) Roles and Responsibilities

The EP Evaluation Team consists of the organizations and personnel responsible for fulfilling the usability testing roles indicated in Table 10-1.

Table 10-1. Usability Testing Roles and Responsibilities

Name	Evaluation	Data Analysis/Report
Developers	• Consult on UT use/design • Participate in UT	• Provide observation note to UT data analysts
Integration & Test	• Consult on UT use and test findings	-
ECS DAAC Liaisons	• Consult on use of EP • Help identify UT Participants	• Assist with understanding of inputs/methods/participation
EP Evaluation Leader	• Conduct Usability Test as Facilitator • Data recording	• Data collection and analysis • EP Evaluation Report prep lead
ECS Configuration Management Office	• Maintain EP Baseline	• Maintain EP Baseline
ECS M&O Office	• Help Desk • EP System Admin. Support	• Help Desk • EP System Admin. Support

10.2.2 Comment Survey Tool (CST)

The Comment Survey Tool is an on-line survey tool that allows evaluators, who are not evaluating the EPs in Landover, to register their comments about the EPs. The CST contains questions about the EP capabilities, applications, interface design, and performance. In addition to questions, a free-text comment field is provided for evaluators to enter any and all comments they have about the EP, the survey, and their evaluation experience. Evaluation responses are written to a database which is queried by data analysis personnel to gather and analyze evaluation input.

Evaluator Selection

Evaluators for EPs are designated by ESDIS, and DAAC managers at ESDIS invitation. Their expertise includes earth science, engineering, V0 development, and User Support. Additionally, the V0 Science Advisors have been invited to evaluate EP to lend their special perspective to the evaluation.

Evaluator Exercise of EP

Evaluators are free to explore all facets of EPs and are encouraged to provide comments on any or all aspects using the CST. They are requested, however, to execute a series of tasks, similar to those used in usability tests at least twice during the evaluation period recording their impressions each time by answering all questions in the CST. The two executions of the tasks should be separated by at least a week.

CST Data Extraction

All survey responses and evaluator comments will be held confidential by the data analysis organization unless a release form is completed by the evaluator. The release form allows development personnel to contact the evaluator to explore implementation preferences indicated by their comments or to clarify their meanings.

Data Compilation and Reporting

Responses retrieved from the database are analyzed. Those evaluators who have signed releases may be contacted at this time for more information or clarification of their comments. The results from data analyses are incorporated into the EP Evaluation Report in conjunction with those results from the usability test.

EPs Roles and Responsibilities

The EP Evaluation Team consists of the organizations and functions responsible for fulfilling the EPs roles indicated in Table 10-2.

Table 10-2. EPs Roles and Responsibilities

Name	Evaluation	Data Analysis/Report
Developers	o Consult on CST use/design	-
Integration & Test	o Consult on CST use and test findings	-
ECS DAAC Liaisons	o Evaluate and take CST Survey o Familiarize remotely located evaluators with EP o Fault resolution	o Assist with understanding of inputs/methods/participation o Coordinate evaluator participation o Consult on EP process
DAAC EP Evaluators	o Receive familiarization from Engineering Liaison o Evaluate EP and take CST survey	
EP Evaluation Leader	o Consult on CST design	o Data analysis o EP Evaluation Report lead
ECS Configuration Management Office	o Maintain EP Baseline	o Maintain EP Baseline
ECS M&O Office	o Help Desk o EP System Admin. Support	o Help Desk o EP System Admin. Support

10.3 Evaluation Groups

10.3.1 Science users

Selection of the appropriate users for each user group is important in order to insure that the results of usability testing and the CST survey are robust. NASA representatives, the DAAC Engineering and Science Liaisons, and other scientists will be asked to provide a list of candidates from the science community to evaluate the EP. This group of evaluators hails from a variety of different research backgrounds and includes the ESDIS "Tirekickers."

10.3.2 Operations and User Services

Besides the science users there are other groups who will be end users of the system, namely Operations and User Services personnel. These users will have different needs and therefore may have different requirements for the EPs than science users. This group of users may do most of their work "behind the scenes," however, they are often the science users' only link to the "insides" of ECS. It is anticipated that this group of EP users will spend a significant amount of time interacting with the science users to help them access EOS data and use the ECS. To make sure that the EPs will be able to accommodate this group's anticipated needs they have been included early on in the EP evaluation process.

Operations and User Services personnel participating in EP evaluation will be selected from those at the DAACs and at ECS in Landover.

10.4 EP Evaluation Results Integration

The results of the EP evaluation are documented in the EP Evaluation Report, which is used as direct input to the objectives setting and design phases of the next life cycle (figure 1).

EP Evaluation Report

Data collected from the EP evaluation is collected, analysed, and summarized in the EP Evaluation Report. The Evaluation Report contains at a minimum the methodology used to evaluate the EP, and the results (statistical information and summarized user comments) are compared, where possible with previous prototype evaluations. The evaluation results are reviewed and the appropriate comments and potential new level 4 requirements input to the User Recommendations Database (URDB).

The EP Evaluation Report serves as direct input to establishing the goals and objectives of the next Evaluation Package. It is also a source of information for those functions continuing in development on the Formal Track.

EP Lessons Learned Document

Written in parallel with the Results Report, a document containing the EP Lessons Learned is produced. It includes those lessons from both EP development and the EP evaluation process. The lessons learned play an important role in the EP development process by ensuring that resources are used more efficiently in the next EP effort.

EP Objectives and Design Update.

The EP Evaluation Report will serve as a direct input in the update of the EP Strategic Planning White Paper; the guiding direction for the EP process. An update of the Strategic Plan will be made at the end of each EP Evaluation.

EP Enhancement.

Each EP is meant to be a short-lived product that is enveloped by the subsequent EP in a expanding set of functionality. Consequently little effort is planned to enhance deployed EPs except for those fixes required to keep it operating.

The CST will remain in use throughout the Evaluation Period. Continued input on the EPs after the Evaluation Period is welcome through direct email to the EP Data Analysts and the User Recommendations Data Base (URDB).

11. EP Maintenance and Operation

The ECS M&O organization plays a central role in procurement, installation, and check-out of EP COTS hardware and software, providing an EP operations environment in the EDF and at each DAAC, providing wide-area communication necessary to support EP deployment and evaluation, and providing support services necessary to operate and maintain EP evaluation. EPs are delivered prior to a formal release and associated full contingent of ECS M&O Organization. Table 11-1 summarizes the EP M&O Responsibilities.

Deployment of each EP at the DAACs and on host servers at the EDF constitutes a delivery to an unofficial M&O status. As such, basic maintenance and operations functions must be performed. These include COTS, procurement, installation and checkout, operation of a fault detection, reporting, and resolution process, operating system administration, hardware and software maintenance, property management, configuration management, and resource scheduling.

No M&O personnel are planned for deployment to the DAACs until the delivery of release A in 1995. Consequently, until that time, all M&O services in support of the EP process shall be performed from the EDF at Landover, MD with coordination and support from the ECS DAAC liaison personnel.

As the EPs are not an operational system, e.g., they are not fully supported by complete life cycle products, software maintenance is the responsibility of the development organizations.

Hardware maintenance is the responsibility of EDS, through a maintenance contract, for ECS project equipment, and the responsibility of HTSC for Hughes capital equipment.

Operation of the EP Workstations at the DAACs is the responsibility of the ECS DAAC Liaisons with assistance from the ECS EDF Help Desk.

Table 11-1. EP M&O Responsibilities

EP M&O Task	Responsible Organization
Installation and check-out of EP COTS hardware and software	ECS M&O
Software Maintenance	Development Organizations
Hardware Maintenance - Project Equipment	EDS Maintenance Contract
Hardware Maintenance - Hughes Capital Equipment	HTSC
EP Operations	ECS DAAC Liaisons with assistance from the ECS EDF Help Desk

Detailed description of M&O tasks are found in the remainder of this section.

11.1 M&O Evaluation Activities

M&O prototyping and evaluation activities are performed in two categories: those performed to support the activities of the ECS segments, and those performed to evaluate products and procedures for eventual use in ECS M&O functions.

11.1.1 M&O Support of ECS Segment Evaluation Activities

- COTS product evaluations. M&O performs all actions to:
    - receive, coordinate, track requests for evaluation products
    - install, administer?, manage, deinstall, ship evaluation products
    - perform all procurement activities in support of evaluation products
    - brief status of all evaluation activities to EP Team management
- M&O provides computing and communication environments to host all ECS COTS and developed product evaluations.

11.1.2 M&O Function Evaluation Activities

- ID processes, procedures, policies for evaluation
    - draft working version documentation
    - try out in support of EPs
    - revise as required
- ID products that could improve M&O efficiency
    - obtain for evaluation under 11.1.1.a above

11.2 EP COTS Procurement and Property Management

M&O procures and manages all COTS products purchased in support of the ECS Program, including those acquired to support EP computing and communication requirements. This responsibility covers both capital and program funded acquisitions.

11.3 EP COTS Product Installation and Check Out

11.3.1 EDF Activities

- Initial Installation. COTS products acquired to support EPs are received by the M&O organization at the EDF where they are unpacked, inspected, installed, checked out, and certified ready for use by EP developers.
- Support to Development and I&T.
- Shipment. Hardware and software to be shipped to DAACs in support of EP deployments is deinstalled and packed by M&O, and shipping contracts are let.

11.3.2 DAAC Activities

- Facilities Planning. M&O performs facilities planning and coordination at the DAACs in coordination with facilities managers at each site. They are assisted in this coordination by the ECS Engineering liaison representatives.

- Product installation. M&O personnel travel to each site to install and check out EP products that require their level of expertise. Some products are installed by the ECS liaison at the site. Determination of method is made by the EP Team prior to shipment.

11.4 EP Configuration Management

Identification of EP hardware and software to an EP baseline is controlled from initial installation at the EDF through final delivery to assure ability to perform maintenance, track changes, and perform property management.

Three baselines are defined for each EP deployed for evaluation (software configurations for those EPs in development are managed by the developer):

1. Hardware Configuration. Defines workstation components.

2. Software Configuration. Defines application software installed.

3. Operating System/Services S/W Configuration. Defines UNIX and DCE set up.

All changes to these baseline configurations must be made under authority of a Configuration Change Request (CCR) approved by the appropriate CCB in accordance with ECS Program Instruction SE-1-002. Change board authorities are:

1. EP Configuration Control Group manages the Operating System/Services S/W Configuration,

2. EDF CCB manages no-cost changes to H/W and S/W configurations,

3. ECS CCB approves all expenditures for EP configuration changes.

11.5 EP Fault Resolution

A process for identification and resolution of faults in EP products has been establish by M&O (Figure 11-1). The process is centered in the EDF System Administrator (SA) and supported by the ECS Help Desk. The process operates from three key concepts:

1. Users need only deal with their local DAAC Liaison to resolve problems.

2. The liaison need only deal with the EDF Help Desk.

3. The EDF System Administrator is the focal point for fault diagnosis and coordination of corrective action.
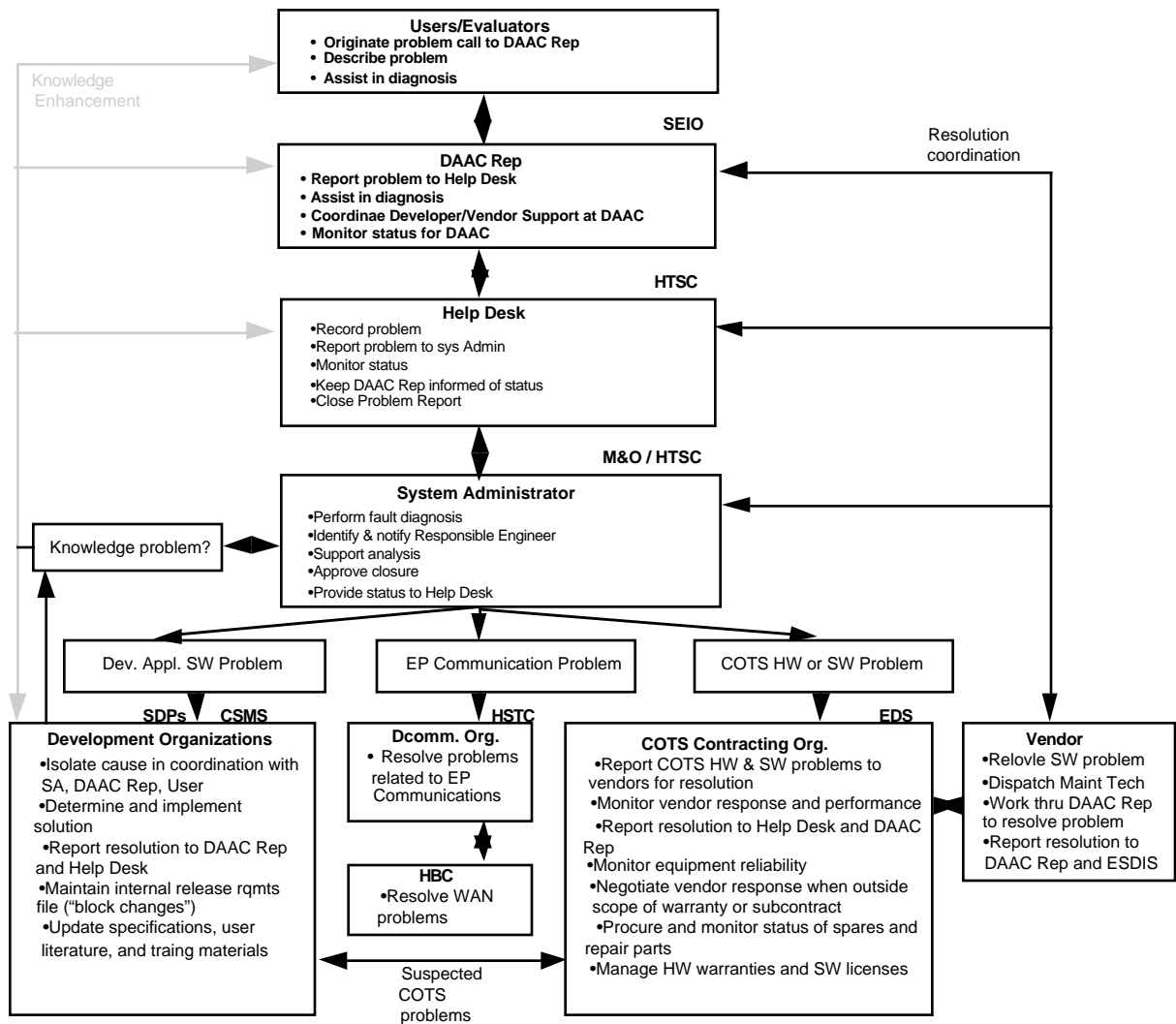
Figure 11-1. EDF Fault Handling Process

11.6 EP System Administration

During the period prior to M&O implementation at the DAACs, System administration for EP workstations is performed centrally by the EDF System Administrator, with selected support from DAAC Liaison personnel.. The EDF SA will produce, distribute, train on, and maintain procedures for local SA operations. Current procedures to be fielded in support of EP2 include:

- Workstation Storage Backup

- EP System Security

- Workstation Shutdown and Reboot

- Addition and Deletion of Users

- DAAC System Configuration Modification

- Installation of Software

- Superuser Privileges

- Workstation Housekeeping

Close cooperation must be practiced among the DAAC liaisons empowered to perform SA functions and the EDF SA. Our current plan allows all liaison personnel access to root functions to gain most efficient operation. All persons performing SA functions must exercise restraint and good judgment to avoid unnecessary system reconfigurations or builds. DAAC liaison personnel should always coordinate any planned change with the EDF SA before they perform it, and the EDF SA must always inform DAAC liaisons before making changes to the DAAC machines.

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Abbreviations and Acronyms

AFS Andrew File System

API Application programming interface

ASF Alaska SAR Facility (SAR: Synthetic Aperture Radar)

CM Configuration Management

CORBA Common Object Request Broker Architecture

COTS Commercial Off-The-Shelf

CSMS Communications and Systems Management Segment

CSR Consent to Ship Review

CSS Communications Subsystem (CSMS)

DAAC Distributed Active Archive Center

DB Data Base

DBMS Database Management System

DCE Distributed computing environment (OSF)

DD Data Dictionary

DDTS Distributed Defect Tracking System

DFS Distributed File System

DME Distributed Management Environment (OSF)

DNS DCE Directory Service

DTR Development Team Representative

ECS EOSDIS Core System

EDC EROS Data Center (EROS: Earth Resources Observations System)

EDF ECS development facility

EDS Electronic Data Systems

EOS Earth Observing System

EP Evaluation Package

EPRR EP Readiness Review

EPS Evaluator Preference Survey

ERF Evaluation Results Forum

ESN	EOSDIS Science Network
ETM	ESDIS Technical Manager
FOS	Flight Operations Segment (ECS)
ftp	file transfer protocol
GSFC	Goddard Space Flight Center
GUI	graphical user interface
HDF	Hierarchical Data Format
HMI	Human-Machine Interface
HTML	HyperText Markup Language
HTSC	Hughes Technical Services Company
I&T	Integration and Test
I/Fs	Interfaces
IATO	Independent Acceptance
IDL	Interface Definition Language (OMG's CORBA Implementation)
IDL	Interface Definition Language (OSF DCE Implementation)
IET	Interactive Evaluation Tool
IP	Internet Protocol
ISO	International Standards Organization
ISS	Internetworking Subsystem (CSMS)
JPL	Jet Propulsion Laboratory
LAN	local area network
LaRC	Langley Research Center
LIM	Local Information Manager
M&O	Maintenance and Operations
MD	Master Directory
MIB	management information base
MIT	Massachusetts Institute of Technology
MSFC	Marshall Space Flight Center
MSS	Systems Management Subsystem (CSMS)
MUI	Management User Interface
NCR	Non-Conformance Report

NSI	NASA Science Internet
NSIDC	National Snow and Ice Data Center
OMG	Object Management Group
OODBMS	Object Oriented Database Management System
ORB	Object Request Broker
ORDBMS	Object Relational Database Management System
OS	Operating System
OSF	Open Software Foundation
OSI	Open Systems Interconnect
PGS	Product Generation Subsystem (obsolete ECS element name)
PI	Project Instruction
PSC	Pittsburgh Supercomputing Center
PO	Purchase Order
QA	Quality Assurance
RDBMS	Relational Database Management System
RPC	Remote Procedure Call
RTM	Requirements and Traceability Management
SDPS	Science Data Processing Segment
SEPG	Software Engineering Process Group
SGI	Silicon Graphics
SI&P	System Integration & Planning
SNMP	simple network management protocol
SOW	Statement of Work
T1	a common-carrier data pipe providing 1.544 Mbps of capacity
TBR	To Be Reviewed
TCP/IP	Transmission Control Protocol/Internet Protocol
TRMM	Tropical Rainfall Measuring Mission (joint US-Japan)
TRR	Test Readiness Review
UT	Usability Testing
V0	Version 0 (of EOSDIS)
WAN	wide area network